

INFINITY IN THE PRESOCRATICS:
A BIBLIOGRAPHICAL AND PHILOSOPHICAL STUDY

Infinity in the Presocratics:
A BIBLIOGRAPHICAL AND PHILOSOPHICAL STUDY

by

LEO SWEENEY, S. J.
The Catholic University of America

Foreword
by

JOSEPH OWENS, C. Ss. R.
Pontifical Institute of Mediaeval Studies



MARTINUS NIJHOFF / THE HAGUE / 1972

© 1972 by Martinus Nijhoff, The Hague, Netherlands

*All rights reserved, including the right to translate or to reproduce this book or
parts thereof in any form*

ISBN-13: 978-90-247-1170-3

e-ISBN-13: 978-94-010-2729-8

DOI: 10.1007/978-94-010-2729-8

To
Lee and Adrian Powell,
James, John, Jeffrey,
Jean, Jay, Jane,
Jerry and Mary Ann

TABLE OF CONTENTS

Abbreviations	IX
Permissions	XIV
Foreword by Joseph Owens	XVII
Introduction	XX
Mondolfo	XXIII
Sinnige	XXVII
Methodology and acknowledgements	XXXI
 CHAPTER ONE: SECONDARY LITERATURE ON ANAXIMANDER	 1
Ancient Sources	2
Recent Studies on Anaximander	5
Vlastos, Jaeger, Burch, Kraus	5
Cherniss, Cornford, Matson, McDiarmid	8
Hölscher, Kirk	14
Wiśniewski, Kahn	20
Guazzoni Foà, Solmsen, Classen	26
Paul Seligman	29
Guthrie, Gottschalk	33
F. M. Cleve	39
Stokes, Bicknell	41
Other Studies?	49
 CHAPTER TWO: ANAXIMANDER AND OTHER IONIANS	 55
Anaximander	55
Anaximenes, Xenophanes, Heraclitus	65
Conclusion	73
 CHAPTER THREE: PYTHAGORAS	 74
J. E. Raven	75

J. A. Philip	84
Conclusions	91
CHAPTER FOUR: THE ELEATICS	93
Parmenides	93
Burnet, Raven and Guthrie	94
Joseph Owens	97
Loenen	99
Tarán	102
Conclusions	105
Zeno	110
Jesse De Boer	112
H. N. Lee	117
Conclusions	119
Melissus	124
Fragment 9	125
Fragment 7	127
Fragment 3	129
Conclusions	130
CHAPTER FIVE: POST-PARMENIDEAN PHILOSOPHERS	136
Empedocles	137
Anaxagoras	144
Infinity and Matter	146
Infinity and Mind	151
Conclusions	155
The Atomists	155
Atomists and Parmenides	156
Indivisibility	161
Infinity	169
CHAPTER SIX: IN RETROSPECT	174
Appendix: Additional Studies on Anaximander	180
Bibliography	185
Index of Topics	206
Index of Passages	214
Index of Names	218

ABBREVIATIONS

The following list gives abbreviations of studies frequently referred to within the text or footnotes, as well as in "Bibliography" *infra*. Abbreviations for titles of journals are ordinarily those given in *L'année philologique* (Paris: Société d'Édition "Les Belles Lettres").

- ABG* *Archiv für Begriffsgeschichte* (Bonn: Bouvier).
- AC* *L'Antiquité Classique* (Louvain).
- AFC* *Anales de Filologia Clasica* (Buenos Aires: Fac. de Filos. y Letras).
- AGPh* *Archiv für Geschichte der Philosophie* (Berlin: W. de Gruyter).
- AIPhO* *Annuaire de l'Institut de Philologie et d'Histoire Orientales de l'Université Libre de Bruxelles* (Bruxelles: Secret. de l'Institut).
- AJP* *American Journal of Philology* (Baltimore: Johns Hopkins U. Press).
- APQ* *American Philosophical Quarterly* (Pittsburgh, Pa.: University of Pittsburgh).
- ASSPh* *Annuaire de la Société Suisse de Philosophie* (Basel: Verl. für Recht und Gesellschaft).
- BAGB* *Bulletin de l'Association G. Budé* (Paris: Les Belles Lettres).
- Bailey Cyril Bailey, *The Greek Atomists and Epicurus* (Oxford: Clarendon Press, 1928).
- Bicknell* Bicknell, P. J. "To *apeiron*, *apeiros aēr* and to *periechon*," *Acta Classica*, 9 (1966), 27-48.
- BJPS* *British Journal for the Philosophy of Science* (Cambridge University Press).
- Burnet, *EGP* John Burnet, *Early Greek Philosophy* (London: A. and C. Black, Ltd., [4th ed.] 1930).
- Cherniss, *ACPP* Harold Cherniss, *Aristotle's Criticism of Presocratic Philosophy* (New York: Octagon Books, Inc., 1964).

- CJ* *Classical Journal* (Athens, Ohio: Ohio University).
- CP* *Classical Philology* (Chicago: University of Chicago Press).
- CQ* *Classical Quarterly* (Oxford University Press).
- Cornford, *PP* F. M. Cornford, *Plato and Parmenides. Parmenides' "Way of Truth" and Plato's "Parmenides" Translated with an Introduction and a Running Commentary* (New York: Liberal Arts Press, 1957).
- Cornford, *Prin. Sap.* F. M. Cornford, *Principium Sapientiae: The Origins of Greek Philosophical Thought* (Cambridge: University Press, 1952).
- CR* *Classical Review* (Oxford University Press).
- CW* *The Classical World* (Newark, N.J.: Rutgers State University).
- DK* Diels, H. and Kranz, W. *Die Fragmente der Vorsokratiker*, 3 vols. (Zürich: Weidmann, [6th ed.] 1951; reprinted 1966).
- EP* *Encyclopedia of Philosophy*, ed. Paul Edwards (New York: The Macmillan Company and the Free Press, 1967).
- Fränkel, *Wege und Formen* Hermann Fränkel, *Wege und Formen frühgriechischen Denkens*, herausgegeben von Franz Tietze (2nd ed.; München: C. H. Beck, 1960).
- Fränkel, *Dichtung* Hermann Fränkel, *Dichtung und Philosophie des frühen Griechentums* (2nd ed.; München: C. H. Beck, 1962).
- Furley, David J. Furley, *Two Studies in Greek Atomists: Indivisible Magnitudes; Aristotle and Epicurus on Voluntary Action* (Princeton University Press, 1967).
- Furley "Aristotle and the Atomists" David J. Furley, "Aristotle and the Atomists on Infinity," *Naturphilosophie bei Aristoteles und Theophrast* (Verhandlungen des 4. Symposium Aristotelicum). (Heidelberg: Lothar Stiehm, 1969). Pp. 85-96.
- G* W. K. C. Guthrie, *A History of Greek Philosophy*. Volume One: *The Earlier Presocratics and the Pythagoreans*. Volume Two: *The Presocratic Tradition from Parmenides to Democritus*. (Cambridge: University Press, 1962 and 1965).
- GM* *Giornale de Metafisica* (Genova: Università).
- Heath Sir Thomas Heath, *A History of Greek Mathematics*. Volume One: *From Thales to Euclid*. Volume Two: *From Aristarchus to Diophantus* (Oxford: Clarendon Press, 1921).
- HSCP* *Harvard Studies in Classical Philology* (Cambridge, Mass.: Harvard University Press).
- IPQ* *International Philosophical Quarterly* (New York: Fordham University Press).

- Jaeger, *TEGP* Werner Jaeger, *The Theology of the Early Greek Philosophers* (Oxford: Clarendon Press, 1947).
- JHI* *Journal of the History of Ideas* (New York: College of the City of New York).
- JHP* *Journal of the History of Philosophy* (Berkeley: University of California Press).
- JHS* *Journal of Hellenic Studies* (London).
- JP* *Journal of Philosophy* (Columbia University).
- Kahn Charles H. Kahn, *Anaximander and the Origins of Greek Cosmology* (New York: Columbia University Press, 1960).
- Kerferd G. B. Kerferd, "Recent Work on Presocratic Philosophers," *American Philosophical Quarterly*, 2 (1965), 130-40.
- Kerschensteiner Julia Kerschensteiner, *Kosmos: Quellenkritische Untersuchungen zu den Vorsokratikern* (München: C. H. Beck, 1962).
- KR G. S. Kirk and J. E. Raven, *The Presocratic Philosophers. A Critical History with a Selection of Texts* (Cambridge: University Press, [4th printing] 1963).
- Kröber Günter Kröber, *Wissenschaft und Weltanschauung in der Antike von den Anfängen bis Aristoteles* (Berlin: VEB Deutscher Verlag der Wissenschaften, 1966).
- Loenen J. H. M. M. Loenen, *Parmenides, Melissus, Gorgias. A Reinterpretation of Eleatic Philosophy* (Assen: Royal Van Gorcum Ltd., 1959).
- LThPh* *Laval Théologique et Philosophique* (Quebec; Ed. de l'Université Laval).
- MH* *Museum Helveticum. Revue Suisse pour l'Etude de l'Antiquité classique* (Bale: Schwabe).
- Mondolfo Rodolfo Mondolfo, *L'infinito nel pensiero dell'antichità classica* (Firenze: "La Nuova Italia" Editrice, 1956).
- Mourelatos A. P. D. Mourelatos. *The Route of Parmenides* (New Haven: Yale U. Press, 1970).
- MS* *Mediaeval Studies* (Toronto: Pontifical Inst. of Mediaeval Studies).
- NCE* *The New Catholic Encyclopedia* (New York: McGraw-Hill Book Company, 1967).
- NS* *The New Scholasticism* (Washington, D.C.: The American Catholic Philosophical Association).
- Owens, *Hist.* Joseph Owens, C. Ss. R., *A History of Ancient Western Philosophy* (New York: Appleton-Century-Crofts, Inc., 1959).
- PAS* *Proceedings of the Aristotelian Society* (Great Britain).

- Philip J. A. Philip, *Pythagoras and Early Pythagoreanism* (Toronto: University Press, 1966).
- PQ *Philosophical Quarterly* (St. Andrews, Scotland: University of St. Andrews Press).
- PR *Philosophical Review* (Ithaca, New York: Cornell University).
- Raven, PE J. E. Raven, *Pythagoreans and Eleatics: An Account of the Interaction Between the Two Opposed Schools During the Fifth and Early Fourth Centuries B. C.* (Cambridge: University Press, 1948).
- RE *Realencyclopädie des klassischen Altertums*, ed. Wissowa, Kroll et al. (Stuttgart: J. B. Metzler; Alfred Druckenmüller, 1892-).
- RecSR *Recherches de Science Religieuse* (Paris).
- REG *Revue des Etudes Grecques* (Paris: Les Belles Lettres).
- RFil (Madrid) *Revista de Filosofia* (Madrid: Inst. Luis Vives).
- RFNS *Revista di Filosofia Neo-scolastica* (Italy).
- RhM *Rheinisches Museum* (Frankfurt: Sauerländer).
- RM *Review of Metaphysics* (Catholic U. of America).
- RPhilos *Revue philosophique de la France et l'Etranger*.
- RPhL *Revue Philosophique de Louvain* (Louvain: Institut Supérieur de Philosophie).
- RIL *Rendiconti dell'Istituto Lombardo* (Milano: Ist. Lombardo).
- RMM *Revue de Métaphysique et de Morale* (Paris: Colin).
- RPh *Revue de Philologie* (Paris: Klincksieck).
- RS *Revue de Synthèse* (Paris: Albin Michel).
- RSF *Revista critica di Storia della Filosofia* (Firenze: La Nuova Italia).
- RSPh *Revue des Sciences Philosophiques et Théologiques* (Paris: Vrin).
- SIFC *Studi Italiani di Filologia Classica* (Firenze: Le Monnier).
- Sinnige Theo Gerard Sinnige, *Matter and Infinity in the Presocratic Schools and Plato* (Assen: Van Gorcum and Company; New York: Humanities Press, 1968).
- Solmsen, *Aristotle's System* Friedrich Solmsen, *Aristotle's System of the Physical World. A Comparison with his Predecessors* (Ithaca, New York: Cornell University Press, 1960).
- Stokes Stokes, M. C. "Hesiodic and Milesian Cosmogonies," *Phronesis*, 7 (1962), 1-25 and 8 (1963), 1-34.
- TAPA *Transactions and Proceedings of the American Philological Association* (Cleveland: Press of Case Western Reserve University).
- Tarán Leonardo Tarán, *Parmenides. A Text with Translation, Com-*

mentary, and Critical Essays (Princeton, New Jersey: Princeton University Press, 1965).

TMS *The Modern Schoolman* (St. Louis, Missouri: St. Louis University).

TPh *Tijdschrift voor Philosophie* (Utrecht: Spectrum).

ZPhF *Zeitschrift für Philosophische Forschung* (Meisenheim: Hain).

PERMISSIONS

The author and publisher wish to thank the following for permission to quote or, on occasion, to paraphrase copyrighted material.

Acta Classica for P. J. Bicknell, "To apeiron, apeiros aēr and to periechon," 9 (1966), pp. 29, 32, 33, 37, 38 and 43.

American Mathematical Monthly for Florian Cajori, "The History of Zeno's Arguments on Motion," 22 (1915), p. 297.

American Philosophical Quarterly for G. B. Kerferd, "Recent Work on Presocratic Philosophers," 2 (1965), p. 130.

Appleton-Century-Crofts, Inc. for Joseph Owens, *History of Ancient Western Philosophy* (Copyright 1959 by Appleton-Century-Crofts, Inc.), pp. 62, 65, 66, 68, 71, 96, 126 and 150.

Archiv für Geschichte der Philosophie for Charles H. Kahn, "Religion and Natural Philosophy in Empedocles' Doctrine of the Soul," 42 (1960), p. 9; for Friedrich Solmsen, "Anaximander's Infinite," 44 (1962), pp. 114, 115 and 126.

Athlone Press of the University of London for Paul Seligman, *The Apeiron of Anaximander: A Study of the Origin and Function of Metaphysical Ideas* (1962), pp. 15, 54-5, 107, 110 and 128.

Cambridge University Press for F. M. Cornford, *Principium Sapientiae: The Origins of Greek Philosophical Thought* (1952), pp. 146-7, 173, 178-9; W. K. C. Guthrie, *A History of Greek Philosophy*, Vol. I: *The Earlier Presocratics and the Pythagoreans* (1962), pp. ix, xx, 70-1, 78, 80, 83, 86-8, 114, 121, 122, 130, 131, 278, 340, 457 and 470-1; Vol. II: *The Presocratic Tradition from Parmenides to Democritus* (1965), pp. 45, 49, 51-2, 91-2, 114, 139, 153, 276-7, 278-9, 328-9, 333-4, 335, 392-3, 406, 503-4; for G. S. Kirk, *Heraclitus: The Cosmic Fragments* (1954), p. 316; for G. S. Kirk and J. E. Raven, *The Presocratic Philosophers* (4th printing, 1963), pp. vii, 105-7, 110, 112, 128, 129, 131, 171-3, 200, 219, 236-8, 250, 252-4, 274, 279, 304, 317-8, 319, 400, 407, 416 and 418-9; for Denis O'Brien, *Empedocles' Cosmic Cycle* (1969), pp. 242-4; for J. E. Raven, *Pythagoreans and Eleatics* (1948), pp. 85, 91, 158 and 163.

Harold Cherniss and *Journal of the History of Ideas* for "The Characteristics and Effects of Presocratic Philosophy," 12 (1951), pp. 324-7.

The Clarendon Press (Oxford) for Werner Jaeger, *Theology of the Early Greek Philosophers* (1947), pp. 24, 33 and 35; for G. B. Kerferd, Review of Tarán's

- Parmenides* in *Classical Review*, n.s. 17 (1967), p. 13; for G. B. Kerferd, Review of Bollack's *Empédocle* in *ibid.*, p. 148; for G. S. Kirk, "Some Problems in Anaximander," *Classical Quarterly*, n.s. 5 (1955), pp. 25, 28-9, 33-4 and 38; for Denis O'Brien, "Empedocles' Cosmic Cycle," *ibid.*, n.s. 17 (1967), p. 37.
- Columbia University Press for Charles H. Kahn, *Anaximander and the Origins of Greek Cosmology* (1960), pp. 5, 6, 20, 21, 41, 199, 207, 209-10, 236, 237 and 238.
- Cornell University Press for Friedrich Solmsen, *Aristotle's System of the Physical World: A Comparison With His Predecessors*, p. 115 (Copyright 1960 by Cornell University). Used by permission of Cornell University Press.
- Éditions De Minuit (Paris) for J. Bollack, *Empédocle* (1965), I, p. 88.
- Études Augustiniennes for E. Gilson, "L'Infinité divine chez Saint Augustin," *Augustinus Magister* (Paris: Études Augustiniennes, 1954), Vol. I, pp. 569 and 574.
- David Furley and Royal Van Gorcum, Ltd., for H. B. Gottschalk, "Anaximander's *Apeiron*," in *Phronesis*, 10 (1965), pp. 43, 46-8 and 50; for E. L. Minar, "Cosmic Periods in Philosophy of Empedocles," *ibid.*, 8 (1963), pp. 128, 133, 135, 139-40; for Friedrich Solmsen, "Love and Strife in Empedocles' Cosmology," *ibid.*, 10 (1965), pp. 120 and 127; for Michael Stokes, "Hesiodic and Milesian Cosmogonies," *ibid.*, 8 (1963), pp. 14, 23 and 29.
- Ginn and Company for Daniel E. Gershenson and Daniel A. Greenberg, *Anaxagoras and the Birth of Physics* (1964), p. 12.
- Harvard Theological Review* for W. K. C. Guthrie, "The Presocratic World Picture," 45 (1952), p. 88. Copyright by President and Fellows of Harvard College.
- Harvard University Press for John B. McDiarmid, "Theophrastus on the Presocratic Causes," *Harvard Studies in Classical Philology*, 61 (1953), pp. 101, 129 and 132-3.
- Humanities Press, Inc., for F. M. Cornford, *Plato and Parmenides* (New York: Liberal Arts Press, 1957), p. 19.
- The Johns Hopkins Press for Gregory Vlastos, "On Heraclitus," *American Journal of Philology*, 76 (1955), p. 366; "Minimal Parts in Epicurean Atomism," *Isis*, 56 (1965), pp. 121-2, 138-40 and 146.
- The Macmillan Company for G. B. Kerferd, "Anaxagoras," *Encyclopedia of Philosophy*, I (1967), p. 116; for Gregory Vlastos, "Zeno," *ibid.*, VIII (1967), pp. 370, 371 and 377.
- McGraw Hill Book Company for Leo Sweeney, S.J., "Infinity," *New Catholic Encyclopedia* (Copyright 1967 by The Catholic University of America), VII, 505.
- Mind* and Harold N. Lee for "Are Zeno's Paradoxes Based on a Mistake?," *Mind*, 74 (1966), pp. 563-5 and 569.
- La Nuova Italia Editrice for Rodolfo Mondolfo, *L'infinito nel pensiero dell'antichità classica* (1956), p. 364.
- The Odyssey Press for Philip Wheelwright, *The Presocratics* (1966), p. 1.
- Les Presses de l'Université Laval for Marcel de Corte, "Mythe et philosophie chez Anaximandre," *Laval Théologique et Philosophique* 14 (1958), pp. 22 and 23.
- Princeton University Press for David J. Furley, *Two Studies in Greek Atomists* (1967), pp. 21, 41, 76, 79-80, 87-8 and 114-5; for Leonard Tarán, *Parmenides: A Text with Translation, Commentary, and Critical Essays* (1965), pp. 37, 106, 107,

108, 119, 159, 193-4 and 278.

Henry Regnery Company for Jesse De Boer, "A Critique of Continuity, Infinity, and Allied Concepts in the Natural Philosophy of Bergson and Russell," *Return to Reason* (1953), pp. 95-6, 98-9 and 112-3.

Review of Metaphysics for G. Burch, "Anaximander, the First Metaphysician," 3 (1949), pp. 147-49; for W. I. Matson, "The Naturalism of Anaximander," 6 (1953), pp. 392-95.

Royal Van Gorcum, Ltd., for J. H. M. M. Loenen, *Parmenides, Melissus, Gorgias. A Reinterpretation of Eleatic Philosophy* (1959), pp. 66-7, 74, 105-6, 109, 164, 165, 167 and 175; for Theo Gerard Sinnige, *Matter and Infinity in the Pre-socratic Schools and Plato* (New York: Humanities Press, 1968), p. 142.

J. D. Sauerländer's Verlag for Walther Kraus, "Das Wesen des Unendlichen bei Anaximander," *Rheinisches Museum*, 93 (1950), p. 378.

Franz Seiner Verlag for C. Joachim Classen, "Anaximander," *Hermes*, 90 (1962), pp. 162 and 167-8; for Uvo Hölscher, "Anaximander und die Anfänge der Philosophie," *ibid.*, 81 (1953), pp. 262 and 417.

Studi Italiani di Filologia Classica for Friedrich Solmsen, "Chaos and Apeiron," 24 (1949-50), p. 248.

The University of Chicago Press for Gregory Vlastos, "Equality and Justice in Early Greek Cosmologies," *Classical Philology*, 42 (1947), pp. 168 and 172.

University of Toronto Press for J. A. Philip, *Pythagoras and Early Pythagoreanism* (1966), pp. 46, 50-2, 61, 71, 79, 90, 92 and 102.

FOREWORD

Throughout the long centuries of western metaphysics the problem of the infinite has kept surfacing in different but important ways. It had confronted Greek philosophical speculation from earliest times. It appeared in the definition of the divine attributed to Thales in Diogenes Laertius (I, 36) under the description "that which has neither beginning nor end." It was presented on the scroll of Anaximander with enough precision to allow doxographers to transmit it in the technical terminology of the unlimited (*apeiron*) and the indeterminate (*aoriston*). The respective quantitative and qualitative implications of these terms could hardly avoid causing trouble. The formation of the words, moreover, was clearly negative or privative in bearing. Yet in the philosophical framework the notion in its earliest use meant something highly positive, signifying fruitful content for the first principle of all the things that have positive status in the universe.

These tensions could not help but make themselves felt through the course of later Greek thought. In one extreme the notion of the infinite was refined in a way that left it appropriated to the Aristotelian category of quantity. In Aristotle (*Phys.* III 6-8) it came to appear as essentially requiring imperfection and lack. It meant the capacity for never-ending increase. It was always potential, never completely actualized. In another extreme it characterized in Plotinus (V, 5, 10-11) a principle entirely above the perfections and limitations that go with the order of being, yet endowed with the power to remain without end and sustain all other indefectible things. But from whatever angle it was approached, it patently clashed with the dominant Greek notion of form as equivalent to perfection.

Nevertheless many Christian thinkers have found the notion of infinity congenial for expressing their conceptions of the perfection of the divine nature and of attributes such as omnipotence and omniscience. The description of God by Gregory of Nazianzen (*Orat.*, XXXVIII, 7, 9) as comprising all within himself "like an infinite (*apeiron*) and undetermined

(*aoriston*) ocean of being” continued to be quoted in patristic and scholastic traditions. “Infinite being” attained in Duns Scotus (*Ordinatio*, I, d. 2, p. 1, q. 1-2, no. 147) the status of the most perfect concept of God that could be reached by the human intellect in its present condition. In the commonly understood sense of infinity Scotus (*Rep. Par.*, I, d. 2, q. 3, no. 2) could regard all thinkers, both Christian and non-Christian, as maintaining that the first being was actually infinite. He could read Aristotle as saying that for all philosophers the first principle was infinite and contained all things. Yet the difficulties arising from the Greek background of the notion were experienced by Origen (*De Prin.*, II, 9, 1) in the reflection that omnipotence would of its nature be incomprehensible even to itself. Today a theologian can rest without too much fear of challenge in the stand that “whether any such speculative idea of infinity has much relevance to the theological understanding of God is very doubtful.”¹

These are widely separated views on an obviously important topic. They have far-reaching consequences on both the philosophical and theological levels. The positions of process philosophy on the requirement of a finite nature for God, the objection that subsistent existence as infinite would leave no room whatsoever for any other beings, the difficulties in understanding how an already infinite God could love and provide for mankind without thereby acquiring new real relations to the ones loved, the seeming clash of human freedom with divine foreknowledge and omnipotence, the problem how an infinite good could tolerate any evils in the world—all these and other such questions are topics of current and lively discussion. Perhaps none has been more notorious in the last two decades than that of the ontological arguments for the existence of God. With Duns Scotus the very possibility of infinite being entailed the real existence of God, in a way substantially the same as seen by recent writers in the second of St. Anselm’s “two quite different arguments.”² The fact that first-class thinkers can diverge so widely and so radically and so uncompromisingly in their discussions on these subjects would suggest that the common parameter, the notion of infinity, has not been sufficiently probed by the participants in the dialogues.

¹John Macquarrie, “Divine Omnipotence,” *Proceedings, Seventh Inter-American Congress of Philosophy* (Quebec, 1967-1968), I, 134.

²Richard Taylor, “Introduction,” *The Ontological Argument*, ed. Alvin Plantinga (Garden City, N.Y.: Doubleday, 1965), p. ix. See Norman Malcolm, *ibid.*: “the logical impossibility of non-existence is a perfection,” p. 142, and “God is usually conceived of as an unlimited being. . . . This is no less than to conceive of Him as something a greater than which cannot be conceived,” pp. 143-144.

What Fr. Sweeney has come to realize more and more in the course of some twenty years of work on the philosophical problem of the infinite, is that any attempt to understand it in abstraction from its historical Greek background is doomed to failure. Even more specifically, its original emergence in Presocratic thinking has to be the starting point. There is no easier way, no short cut. The extant texts of the Presocratics have to be carefully studied, and the wealth of modern research on them has to be painstakingly assembled and critically gauged. This exacting and time-consuming task has been carefully carried out by Fr. Sweeney, and its results are presented in a readable style and a form convenient for consultation in the following pages. The survey of recent literature is exhaustive and should be invaluable for seminar work and for occasions when a rapid panoramic view of the present state of research on the subject is demanded. The scholarly character of the treatment throughout is beyond question. It is a pleasure to recommend this book both to those who are interested in Presocratic philosophy in general and to those who are occupied with the problem of infinity in any of its numerous ramifications through currently discussed philosophical and theological problems.

Joseph Owens, C.Ss.R.

Pontifical Institute of Mediaeval Studies, Toronto 5, Canada.

INTRODUCTION

Perhaps the most convenient way of presenting this book is through some autobiographical data. During the course of a seminar on St. Augustine's *Confessions* at the University of Toronto in the Fall of 1951, Etienne Gilson invited me to work on divine infinity in Augustine as the topic of a doctoral dissertation. He had recently become aware of how problematical infinity was while writing his book. *Jean Duns Scotus: Introduction à ses positions fondamentales*. He found Scotus, as well as Thomas Aquinas, Henry of Ghent and other medieval authors, speaking frequently and at length of God as infinite.¹ But Augustine? Where did he express his doctrine on the topic? As Gilson would later state at the "Congrès International Augustinien" held in Paris, September 21-24, 1954,

la place occupée par cette notion dans les œuvres d'Augustin est si peu importante, du moins à première vue et jusqu'à plus ample informé, qu'il n'est pas impossible d'écrire un livre sur sa doctrine, non seulement sans parler de l'infinité divine mais même sans s'apercevoir qu'on n'en parle pas.²

The book of which Gilson spoke was, of course, his *Introduction à l'étude de saint Augustin*, the third edition of which appeared in 1949.³ Even by 1954 he had discovered only eight places in Augustine's entire *corpus* which discussed infinity.⁴ He concluded his Paris lecture by calling attention to the importance of the topic.

... vaut-il mieux attirer l'attention sur l'importance qu'offrirait des recherches

¹ Paris: J. Vrin, 1952. See "infini" and "infinité" in "Index des matières," p. 692. Gilson completed writing the book by December, 1949 (see *ibid.*, p. 9) and was reading pageproofs by Fall, 1951.

² "L'infinité divine chez Saint Augustin," *Augustinus Magister* (Paris: Études Augustiniennes, 1954), vol. I, p. 569.

³ Published by J. Vrin, Paris. Only two references to infinity are found in the "Index des questions traitées" (p. 358): "intelligible pour Dieu," pp. 249-50 and "infinité du nombre," pp. 259-61.

⁴ See "L'infinité divine chez Saint Augustin," pp. 570-72.

sur le développement de la notion métaphysique de l'infini positif, depuis ses origines cappadociennes, ou peut-être plotiniennes, en passant par Augustin, Denis, Damascène, et suivant ensuite le courant médiéval jusqu'à Nicolas de Cuès. On ne refuserait pas leur part aux Grecs, pas même au Philosophe qui, en attribuant l'infinité de puissance au premier Moteur, a joué un rôle, modeste sans doute, mais non pas nul. On veut espérer que l'histoire de cette notion, l'une des plus fondamentales de la philosophie chrétienne, attirera bientôt l'attention des historiens.⁵

His invitation to me in 1951 was, of course, an earlier but similar alert, and I gratefully accepted it. Some weeks later I asked to work on infinity in Aquinas rather than in Augustine. My fear was that Augustine spoke of infinity so rarely that it might not prove feasible as a dissertation topic. On the other hand, the thirteenth-century theologian had elaborated a clear and consistent theory of both divine and quantitative infinity. Moreover, some of this elaboration had occurred while he was commenting upon Greek authors or treatises (Aristotle, Dionysius the Pseudo-Areopagite, and the anonymous semitic *Liber de Causis* culled mainly from Proclus' *Elements of Theology*). By investigating also the authors commented upon, as well as some of those who had influenced them, one would have at least begun to trace how the concept of infinity might have arisen and developed. My dissertation, presented to the University of Toronto in November, 1954, was the result of that investigation and consisted of chapters on Aristotle, Plotinus, Proclus, Pseudo-Dionysius and *Liber de Causis*, as well as on Aquinas himself.⁶

It is now fifteen years later and I am presenting what I hope is the first of a series of volumes on the history of infinity. Why begin the series at this time? For one reason because the past few years have seen the publication of several comprehensive and well documented studies which provide reliable help – for example, G. S. Kirk and J. E. Raven, *The Presocratic Philosophers* (Cambridge: University Press, [4th printing] 1963); W. K. C. Guthrie, *A History of Greek Philosophy*, Volume One: *The Earlier Presocratics and the Pythagoreans*. Volume Two: *The Presocratic Tradition from Parmenides to Democritus* (Cambridge: University Press, 1962 and 1965); A. H. Armstrong (ed.), *The Cambridge History of Later Greek and Early Medieval Philosophy* (Cambridge: University Press, 1967).⁷ Secondly, I currently am somewhat less inadequate for the

⁵ *Ibid.*, p. 574.

⁶ I also examined Plato's doctrine but I did not include that chapter in the dissertation, which was over five hundred pages in length.

⁷ Other instances will be clear from my references and citations within this and subsequent volumes. W. K. C. Guthrie is currently working on Plato and Aristotle and intends his history eventually "to include the Hellenistic period, stopping short of the Neoplatonists" (G. vol. I, xi).

task than previously because of having taught graduate courses on Plato, Aristotle, Plotinus, Proclus, Pseudo-Dionysius and other Greek writers, as well as on Aquinas, Bonaventure and other Franciscans, Albert the Great, Avicenna and Averroes, and so on. I have also published articles on several Greek and medieval authors⁸ and directed some theses and dissertations.⁹ But the final reason is perhaps strongest. Time is speeding by so fast that I must start before it is too late. To paraphrase Hermann Fränkel: although additional research would be highly desirable in itself, it seems more important to finish (at least, to attempt to finish) the task during my lifetime.¹⁰

Hence, *Infinity in the Presocratics* is the first of a projected series of volumes. The second and third will concern Plato and Aristotle, to be followed (please God) by volumes on Neoplatonists (pagan and Christian), medievals, moderns and contemporaries.

There is little need of delaying on the advantages or, even, necessity of starting with the Presocratics. They furnish important insights into contemporary ways of thinking. As Robert S. Brumbaugh observes, "we are still seeing the world in an ancient Greek way, and . . . there is a gain in seeing clearly the ideas which are by now so built into our thinking that we are unaware of them."¹¹ They also help us understand Plato and Aristotle more authentically, neither of whose "achievements would have been possible without the two centuries of analysis and speculation that had gone before."¹² They are interesting and significant also in themselves. "The period of less than two hundred years between Thales and Democritus shows a development in the art of philosophical inquiry that is quite unparalleled in world history. Nowhere else, not even in ancient India, is there shown so striking a combination of conceptual imagination, attempted linguistic precision, and concern for intellectual consistency."¹³ In that period *apeiron* underwent a rather lengthy odyssey from its first appearance in Anaximander through its eclipse in Parmenides to its re-appearance in Anaxagoras and the Atomists.

⁸ See my publications listed below in "Bibliography."

⁹ See the following names in "Bibliography": Catania, Daly, Duggan, Gelpi, Kalton, Kessler, McCaslin, O'Keefe, Prather. Also see Dubrule.

¹⁰ H. Fränkel, *Dichtung und Philosophie des frühen Griechentums* (München: C. H. Beck, [2nd ed.] 1962), p. VII.

¹¹ *The Philosophers of Greece* (New York: Thomas Y. Crowell Company, 1964), p. 2. Also see G, vol. I, 1; G. Kröber, pp. 7-13, for a Marxist interpretation of the relevance of Greek thought to current materialism.

¹² Philip Wheelwright, *The Presocratics* (New York: The Odyssey Press, Inc., 1966), p. 1. Also see R. S. Brumbaugh, *The Philosophers*, p. 3.

¹³ P. Wheelwright, *Presocratics*, p. 1.

Accordingly, one starts with the Presocratics with good reason. Before turning to them, though, let us check secondary literature on their positions on infinity. There are several relevant investigations, of which the following seem especially noteworthy: R. G. Bury, "To *apeiron* in Early Greek Thought," in *The Philebus of Plato* (Cambridge: University Press, 1897), pp. 178-89; Jonas Cohn, "Die griechische Philosophie," in *Geschichte des Unendlichkeitsproblems im abendländischen Denken bis Kant* (Leipzig: H. R. Engelmann, 1896; [reprint] Hildesheim: Georg Olms, 1960), pp. 12-35; Erich Frank, "Die Entwicklung des Begriffs vom Unendlichen" in *Plato und die sogenannten Pythagoreer* (Tübingen: Max Niemeyer, 1923; [reprint] Darmstadt: Wissenschaftliche Buchgesellschaft, 1962), pp. 46-64; Henri Guyot, "De Thalès à Démocrite," in *L'infinité divine depuis Philon le Juif jusqu'à Plotin* (Paris: Félix Alcan, 1906), pp. 1-20; C. Huit, "Les notions d'infini et de parfait," *Revue de philosophie*, 5 (1904), 738-57 and 6 (1905), 44-66; P. Kucharski, "L'idée d'infini en Grèce," *RS*, 34 (1954), 5-19; Paul Tannery, "Pour l'histoire du mot '*apeiron*,'" *Revue de philosophie*, 5 (1904), 703-707; A. Tumarkin, "Der Begriff des *apeiron* in der griechischen Philosophie," *ASSPh*, 3 (1943), 55-71.

Despite the insights those studies give (as will be evident below from references to them in our footnotes), they are relatively brief and, hence, are not exhaustive. But there are two books on the topic: Rodolfo Mondolfo, *L'infinito nel pensiero dell'antichità classica* (Firenze: "La Nuova Italia" Editrice, [2nd ed.] 1956) and Theo Gerard Sinnige, *Matter and Infinity in the Presocratic Schools and Plato* (Assen: Van Gorcum and Company; New York: Humanities Press, 1968). These we must examine to see if they eliminate the usefulness of our own work.

RODOLFO MONDOLFO

Mondolfo's book first appeared in 1934 under the title, *L'infinito nel pensiero dei Greci* (Firenze: Felice le Monnier; pp. viii + 440) and reappeared in 1956 under a new title so as to include Roman authors: *L'infinito nel pensiero dell'antichità classica*. In this second edition the Italian scholar revised the text slightly, extended or rewrote footnotes, expanded "Parte Prima" on the origin of the notion of infinity in Greece by a new chapter concerning "L'elemento dionisiaco contro l'apollineo" (pp. 15-25). He also added "Parte Quinta," a sixty-five page discussion of two types of infinity which reviewers of the first edition had pointed out were not treated: "infinity of the instant" (the elimination of the image

of spatial extension in dealing with duration, so that the present moment can be said to be infinite; pp. 557-70) and "subjective infinity" (the feeling of the limit-transcending power of man's mind whereby he assimilates himself to the activity of God; pp. 571-606, plus an appendix [pp. 606-615] on "L'infinito e le antinomie logiche nella filosofia antica").

Yet however much the second edition may differ from the first, its aim remains the same: to refute the neo-humanist view (spread by Lessing, Winckelmann, Goethe and Schiller and reactivated somewhat by F. W. Otto, W. Jaeger and J. Stenzel in the twentieth century) that the Greeks were so preoccupied with limit, symmetry and harmony that they were negligent in (or even incapable of) appreciating infinity, which is a characteristic of modern thought only. Not so, argues Mondolfo. Most if not all the Greeks were aware of infinity. They conceived time as infinite ("Parte Seconda: L'infinità del tempo e l'eternità nella teologia e nella filosofia greca," pp. 47-182), viewing it either in the ever-recurring cycles of change (Heraclitus, Empedocles) or as identical with the primordial *apeiron* which limit draws into the universe (Pythagoreans) or as an endless chain of cause and effect (Atomists) or as the moving image of eternity (Plato) or as the measuring process of endless circular motion (Aristotle). They considered number to be infinite ("Parte Terza: Il numero infinito e l'infinitesimo," pp. 185-267) through reflecting upon infinitely numerous worlds (Anaximander and other cosmologists, Atomists), as well as upon numerical infinity itself (Pythagoreans, Plato, Aristarchus, Archimedes, Aristotle) and the infinitesimal (initiated by the Pythagoreans and Zeno of Elea, developed by Anaxagoras, Democritus, Archimedes). Spatial extension too was infinite to them, a topic which Mondolfo develops in the fourth and longest portion of the book: "L'infinità delle grandezze estese (universo e spazio) e l'infinità della potenza universale divina" (pp. 271-548). Here he touches on (among other things) Anaximander's primal *apeiron*; Ionian, Pythagorean and atomistic multiple worlds; infinitely expanding sphere (Parmenides, Empedocles, Zeno and Anaxagoras); tension between *apeiron/peras* in Plato; Philolaus' heliocentric astronomy; divine power as positively infinite (Aristotle, Philo).

Obviously, Mondolfo has established that neo-humanism was a simplistic view and that the many-sided Greek mind was familiar with infinity no less than limit. Obviously, too, Mondolfo's book is a comprehensive study of Presocratic notions of infinity. Has it rendered a new study of the topic unnecessary? The question is not rhetorical. One reviewer called Mondolfo "a venerable scholar who has calmly dispensed the wisdom gained from a lifetime's reflection on his theme" (E. R. Hill, *JHS*, 79 [1959], 176).

Another described his first edition as a work “done so thoroughly that it hardly seems likely that it will be necessary for anyone to go over the field again” (C. N. Smiley, *CJ*, 32 [1936-1937], 371).

My reaction to the last statement must be disagreement. A new investigation appears necessary for several reasons. It can take into account relevant literature which has appeared since 1950, the date of the most recent study to which Mondolfo refers (Jean Zafiropulo, *L'Ecole Eléate. Parménide-Zénon-Melissos* [Paris: Les Belles Lettres, 1950]). It can be especially attentive to English and American studies, which Mondolfo slights.¹⁴ It can substitute a different approach for Mondolfo's, who used what might be called a topic-method. He studied separately time, number, extension and divine power, an instant, the subjectual. This means that an individual author (e.g., Anaximander or Pythagoras or Anaxagoras or Aristotle) keeps reappearing in distinct sections of the book, with the result that the full exegesis of his texts may never occur at any one place. His position on *apeiron* is presented piecemeal – in connection now with time, now with number, now with extension, and so on. In our approach we have utilized the author-method. We focus on individual authors one by one and on all the texts in which each mentions infinity so as to isolate in a single section his entire position on the topic.

There is still another reason: the goal Mondolfo set out to reach in the book (namely, to establish against neo-humanism that the Greeks were aware of infinity) has led him to misread some authors. Let us take Aristotle and Parmenides as examples. According to Mondolfo one finds in Aristotle two kinds of infinity. The first is a negative concept, is marked by privation, involves a process and series, is incomprehensible, and has to do with quantity. The other is a positive concept, is marked by completion, perfection and knowledge, and is applied to the power of the First Movers.¹⁵ This reading of Aristotle is open to serious doubt since his texts can be interpreted differently. True enough, he does describe the power of a First Mover as infinite, which he thereby indicates to be perfect. But infinity here need directly describe only the effects of that mover and would be applied to his power merely in reference to them. The phrase, “infinite power,” then, does not mean that his power itself (and the entity

¹⁴ See E. R. Hill, *JHS*, p. 175: “It is disappointing to find that little account has been taken of other important studies, many of them in English, which have appeared since 1934.” The two important studies Hill refers to in Mondolfo's second edition are F. M. Cornford, *Plato's Cosmology* (New York: Humanities Press, 1937) and H. Cherniss, *Aristotle's Criticism of Plato and the Academy* (Baltimore: The Johns Hopkins Press, 1944).

¹⁵ Mondolfo, pp. 455-63, especially 456-57.

of which it is a property) is infinite but simply states that it is great enough to cause endless motion through infinite time. But infinity of motion and of time is for Aristotle reducible to that of quantity. In this interpretation, therefore, he holds only one sort of infinity – that which quantity involves.¹⁶ Hence, Mondolfo's view of Aristotle as positing *l'infinità della potenza divina* as a second and positive sort of infinity appears erroneous. It can be traced to his strong conviction, because of a preoccupation with the neo-humanists, that the Greeks achieved a highly developed theory of infinity.

As a second example let us consider how he interprets some lines in Parmenides' Fragment 8. Being is ungenerated and indestructible (line 3) and, hence, enjoys eternal immutability. This in turn means that it is completely outside time and succession: it transcends past and future times (lines 5-6) and resides solely in the eternal, immutable present. This extratemporal eternity amounts to a negation of any temporal limit. Hence, Being's infinity consists in its superiority and transcendence of such determination, limit, negation. This is the force of *ateleston* in line 4: eternal Being is infinite because it is without temporal termination – it is without beginning or end.¹⁷

Later Mondolfo returns to Fragment 8 when discussing *la sfera infinita*. Parmenides' Being excludes any sort of internal multiplicity and diversity and, thus, is absolutely homogeneous in nature. One must conceive it, then, as a sphere, since this shape nowhere allows any diminution in being and is everywhere equal. But one must think of it not as enclosed by a limiting surface but as extending equally in all directions. Such is what Parmenides intends by lines 22-25 and 44-48. Parmenides' vision of Being is, then, dynamic rather than static.¹⁸ Being constantly advances with equal energy from center toward a limit that is everywhere equal (and, we might add, everywhere absent). It is not so much a sphere as an

¹⁶ See L. Sweeney, S.J., "L'infini quantitatif chez Aristote," *RPhL*, 58 (1960), 505-528. Let us take this occasion to correct some rather serious printing mistakes in this article which the proofreaders at *RPhL* did not catch.

Page 505, line 5 read: quantité *instead of*: qualité.

Page 505, line 4 from bottom: read: bibliographies *instead of*: biographies.

Page 506, last line: read: pp. 516 sq. *instead of*: pp. 10 sq.

Page 509, line 14: read: chapitres *instead of*: paragraphes.

Page 509, line 15: read: ces paragraphes semblent *instead of*: ils semblent.

Page 521, line 1: read: Moteur *instead of*: Mouvement.

Page 523, line 10: read: grand *instead of*: prand.

¹⁷ Mondolfo, pp. 92-93.

¹⁸ *Ibid.*, pp. 364-65. As his frequent references and quotations show, Mondolfo has been deeply influenced by G. Calogero, *Studi sul Eleatismo* (Roma: Tipografia del Senato, 1932).

eternal progress in the homogeneous form of a finite sphere. Accordingly, Being is infinite as free from any spatial limits, as well as from any temporal ones. Thus *ateleston* (line 4) has to do with both time and space. Being is limitless both temporally and spatially.¹⁹

Let our comments be as brief as our paraphrase of Mondolfo has been long. Parmenides does consider past and future times to be unreal, but, as J. Tate has pointed out (*CR*, n.s. 8 [1958], 170), "denial of the reality of temporal succession hardly amounts to the assertion of... a positive doctrine of 'eternity,'" in which Being would be "extratemporal" and eternally present all-at-once.²⁰ Moreover, if Being is immutability (this characteristic the texts do establish), how can it simultaneously be a process of constant expansion? This is, indeed, "a subtle, paradoxical, and in the end incredible view" (E. R. Hill, *JHS*, 79 [1959], 176). It is a view without textual justification. It is also, I suggest, a view which Mondolfo's over-reaction to the neo-humanist interpretation made plausible or, even, inevitable.

In summary, then, one may praise Mondolfo's "book for width of learning and smoothness of exposition. But as an attempt to synthesize the heterogeneous utterances of antiquity on the 'infinite' it cannot be regarded as a success" (J. Tate, *CR*, p. 171). Hence, it does not eliminate the usefulness of a new study of infinity in the Presocratics.

But what of Sinnige's book?

THEO GERARD SINNIGE

As its title indicates, Sinnige's *Matter and Infinity in the Presocratic Schools and Plato* traces the history of both matter and infinity in the Presocratics as well as in Plato. Since it became available only after I had finished my own book, I shall survey it rather thoroughly here and merely refer to it in footnotes of later chapters.²¹

What noteworthy (although, on occasion, questionable) points does Sinnige make? Through an adroit and convincing exegesis of the "proverbial sayings" found in Diogenes Laertius, I, 35, he argues that Anaximander's *to apeiron* descended intellectually from the Time-deity of

¹⁹ Mondolfo, pp. 366-67. See Tarán, pp. 155-56.

²⁰ See Tarán pp. 175-83, for an explanation of Mondolfo's theory and a helpful critique. But see C. H. Kahn, *Gnomon*, 40 (1968), 127-29: *infra*, n. 189.

²¹ Parenthetical references to pages in immediately subsequent paragraphs are to Sinnige. Much of what is said in those paragraphs is taken from my review of his book in *TMS*, 47 (1970), 229-30.

ancient myths and, thus, is itself divine (pp. 1-14). Xenophanes' and Parmenides' positions also are descendants of the same myth, which tends to beget monisms (pp. 52-53; also see pp. 15-48). Pythagoreanism, though, has Orphism as ancestor and thus is dualistic in its cosmogony and cosmology (pp. 49-62). In his paradoxes and plurality-arguments Zeno is not defending Parmenides but is elaborating a new logical method, transferred from mathematics to philosophy, for testing suppositions of reason and, thus, for finding a new starting-point for dialectics and metaphysics (pp. 88-110, 128, 146). Anaxagoras' *nous* is not a Craftsman working for a preconceived goal but is rather a vital principle of evolution within the universe (pp. 121-26). If one judges by his extant fragments, Democritus is mainly interested in ethical subjects (p. 138). His atomism is a physical and not a mathematical or metaphysical theory (pp. 150, 152, 155, 164). The greatest influence upon him is Ionian, not Eleatic (vs. Aristotle's interpretation).²² Plato's *Timaeus* basically results from combining Empedocles' theory of four elements with Theaetetus' mathematical doctrine of five regular solids (pyramid, cube, octahedron, icosahedron, dodecahedron, all of which have triangles as ultimate elements; pp. 173, 194-96, 206). In that dialogue one can detect the influence of all the Presocratics (Anaximander, Pythagoras, Anaximenes, Parmenides, Empedocles, Anaxagoras) with one exception: Democritus (vs. Archer-Hind, Zeller, Natorp, Hammer-Jansen, etc.). Plato never mentions him, shows no knowledge of his theory, makes no use of atomism in his mathematized cosmology (pp. 172-215).

In the course of the book Sinnige also outlines a history of infinity which, in my judgment, is not convincing. (1) Anaximander introduced the concept of "infinity" into Western philosophy. *To apeiron* indicated a primal reality which was unbounded spatially and temporally, inexhaustible in resources, all-embracing – in fact, the term had almost any relevant meaning except "indeterminate" (pp. 1-14, 47, 62, 83, 106). (2) This last meaning it acquired only when Pythagoras contrasted it with *peras*, "limit" or "determinant." Pythagoras' move was a step backwards: with Anaximander infinity was positive, lofty and actual; now it is negative, naive and potential (pp. 63-84, 101, 133-34). (3) Parmenides regained the distance lost by renewing Anaximander's positive meaning when in Fr. 8,

²² Sinnige strongly challenges the trustworthiness of Aristotle's accounts of the doctrines of others. For example, p. 142: "As regards historical information we can rely on Aristotle probably to the same degree as we can rely on Heidegger when he gives statements on Aristotle. The theories are completely transformed by the manner in which they are presented to the reader." Also see pp. 18-19, 26, 58, 125, 142-49, 155, 160, 166-67.

4 he termed Being *ateleston* – “all-embracing, endlessly extended” (pp. 38, 44-46, 85, 106). (4) Infinity suffered a set-back with Zeno, who again took up its negative meaning of “undetermined” and subdivided it into infinity through addition and through division. By the former process no line actually infinite in length can be achieved; by the latter absolute zero can never be reached actually (pp. 47, 130-31). (5) The notion leaped forward with Anaxagoras, who actually anticipated Bolzano’s and Cantor’s theory of infinite sets. His Fragments 5 and 6 signify that “all elements of any infinite set taken together, i.e. the sum total (*ta panta*) of a set must be taken as a determined whole remaining equal to itself and not being greater or smaller than its own quantity.” This insight contains the solution of Zeno’s “problem: how to combine infinity and determinateness.” It also is the “earliest text in which we find a correct formula of a mathematical definition of infinity, as it has its place in the theory of infinite sets” (p. 131; see pp. 129-34). (6) But Anaxagoras’ adjustment “did not survive its author” (p. 133) and regression set in. Democritus dropped the entire problem of infinite division by settling upon atoms as the fundamental factors of his cosmos (pp. 47, 133-34). Plato returned to Pythagoras’ couplet, *peras/apeiron*, and, thus, reactivated “the negative meaning of cosmic void and indeterminate principle.” In mathematics *apeiron* is identical with “a measurable field,” in cosmology with empty space, in metaphysics with indeterminate substrate (p. 62; also see pp. 47, 83, 210). (7) With Aristotle infinity hit its nadir among Hellenic philosophers. It is negative, imperfect, incomplete, potential. It merely is any definite quantity conceived without the termini which it actually has. No matter how far bisection of a line has advanced, the parts remaining are always capable of subdivision. No matter how long a line or how large a sum of numbers one takes, more can always be added (pp. 83, 101, 134-35, 143-49).

Almost every stage in that history can be challenged. But first one general criticism. Characterizing infinity as negative and positive is misleading and erroneous at this early and unsophisticated stage of its history. The notion now is negative only. It indicates the *absence* of end, limit, determinant, and so on. What is “infinite” is literally end-less, limit-less, non-finite, non-determinate, bound-less. Rather than negative *vs.* positive, the contrast should be imperfect *vs.* perfect. Infinity is a perfection if the determinant (or what-have-you) which it states to be absent would be an imperfection if present. It signifies an imperfection if the determinant it states to be absent is a perfection which the subject should have.

Now some brief critical comments on the history itself (which will be

substantiated in the chapters below). (1) Even in Anaximander *apeiron* signifies “indeterminate” – at least such is the interpretation of several scholars: Burch, Wiśniewski, Gottschalk, Cleve, Guthrie, Kirk, Kraus, Fränkel, Bicknell, as well as Simplicius, *In Physicorum*, 24, 28. As the common origin of the primordial opposites, it is unlike any one of them. It is neither hot nor cold, neither dry nor moist. It is simply dissimilar to any of the sensible things we know. It is, in a word, indeterminate, *aoriston*. But if Anaximander’s *apeiron* in one of its meanings is synonymous with *aoriston*, then the entire history Sinnige has constructed collapses since its keystone is that *apeiron* becomes identified with *aoriston* only with Pythagoras, with whom *apeiron* becomes negative, naive and potential in contrast to its positive, lofty and actual status in Anaximander. (2) Moreover, *apeiron* in early Pythagoreanism is not the sheer indeterminacy which Sinnige’s construction needs since it is by nature void, *breath and time*.²³ (3) If one reads ἀτέλεστον in Parmenides’ Fragment 8, 4, then Parmenides contradicts himself in Fr. 8, 32 (οὐκ ἀτελέτητον) and Fr. 8, 42 (τετελέσμενον). Accordingly, Tarán’s emendation of Fr. 8, 4 to ἡδὲ τελεστόν appears better.²⁴ But this emendation weakens Sinnige’s theory since now Parmenides does not view Being as infinite but solely as completely determined and definite. (4 and 5) A more likely and less anachronistic interpretation of Anaxagoras’ Fragments 5 and 6 is to see in them an anticipation of Aristotle’s theory of potential infinity through division and addition. Moreover, one should not reject too hastily David J. Furley’s suggestion that Anaxagoras’ theory preceded and triggered Zeno’s.²⁵ (6 and 7) Although Leucippus and Democritus refused the infinite divisibility of matter, still theirs is an infinitist cosmos. An infinitude of atoms coalescing into innumerable worlds within an infinitude of space adds up to a sum of things, a totality, an All which is itself infinite. In fact

²³ For texts and exegesis, see G, vol. I, 277 and 280.

²⁴ L. Tarán, pp. 82, 93-95. Sinnige’s interpretation of Fr. 8, 4 is similar to and influenced by Mondolfo.

Sinnige is unacquainted with Tarán’s study, which is somewhat surprising since it appeared in 1965. As for other contemporary research, he lists two of the 1965 studies which recommend re-thinking Empedocles’ cosmogony (Uvo Hölscher, “Weltzeiten und Lebenszyklus. Eine Nachprüfung der Empedokles-Doxographie,” *Hermes*, 93 [1965], 7-33; F. Solmsen, “Love and Strife in Empedocles’ Cosmology,” *Phronesis*, 10 [1965], 109-148), but he seems to have made little use of them and he makes no reference to Jean Bollack, *Empédocle*. Tome I: *Introduction à l’ancienne physique* (Paris: Editions de Minuit, 1965), who makes the same recommendation.

²⁵ *Two Studies in Greek Atomists*, p. 76. Sinnige cannot of course be expected to have used Furley’s book, which appeared in 1967. He should, though, take it into account in a second edition.

Aristotle (*Physics*, III, chs. 4-5) uses their position as a foil to his own theory that infinity is aligned with potentiality. Their infinity is, then, linked with actuality. The infinite All is that which has nothing outside it and, thus, is complete and whole precisely because it has no end or limit and, hence, encloses everything whatsoever, even infinite atoms and worlds. With them the theory of infinity has not regressed but advanced.²⁶ In reference to Plato let us restrict ourselves to remarking that there appears to be no firm evidence (textual or otherwise) for Sinnige's statement that according to the *Philebus* "the *apeiron* ceases to exist when it receives its determination from a *peras*" (p. 212; also see p. 103).

Such comments suggest that Sinnige's book is not entirely satisfactory and, hence, does not nullify my own attempts to re-examine infinity in the Presocratics.

METHODOLOGY AND ACKNOWLEDGEMENTS

One aspect of the procedure I have followed in researching and writing my study has already been noted when discussing Mondolfo's book. Instead of his topic-method, I used the author-method. That is to say, I concentrated on an individual philosopher and his relevant texts until the basics of his position on infinity are isolated in a single section.²⁷ Other aspects of procedure are worked out below in Chapter One, but let me outline them here in anticipation. Convinced of the necessity of using contemporary literature in interpreting and assessing the Greek texts, I rather extensively surveyed publications from 1947 to 1970 on Anaximander, who initiated the philosophical doctrine of infinity in the West and who strongly influenced other Presocratics. With regard to these latter I leaned somewhat heavily on two books already mentioned: G. S. Kirk and J. E. Raven's *The Presocratic Philosophers* and W. K. C. Guthrie's *A History of Greek Philosophy*. But I also made a rather careful check of other studies: those written since Kirk-Raven (1963) and Guthrie (1962 and 1965) published theirs and those published before the mid sixties but

²⁶ Gregory Vlastos' article, "Minimal Parts in Epicurean Atomism," *Isis*, 56 (1965), 121-45, contains enough information on Leucippus and Democritus to have merited study and would have helped correct Sinnige's simplistic interpretation of the indivisibility and infinity of their atoms. Another corrective is David J. Furley's study of "Indivisible Magnitudes" in *Two Studies in Greek Atomism*.

²⁷ I might add that I have no axe to grind (as did Mondolfo) in interpreting those texts.

needing more attention for my purposes than Kirk-Raven and Guthrie paid them. This methodology has, I hope, enabled me to achieve a reasonable accurate and clear understanding of infinity in the Presocratics.²⁸

It is my pleasant duty now to thank those who have directly helped me publish this book: Joseph Owens, C.Ss.R., University of Toronto and Pontifical Institute of Mediaeval Studies, who has advised me on many intellectual and practical points and who has written its "Foreword"; M. Joseph Costelloe, S.J., and John Jelinek, S.J., Creighton University, who read through the entire manuscript; the administration of Fusz Memorial in St. Louis, who financed a sabbatical year in 1967-1968; the administration of Creighton University, who arranged a Research Professorship from 1968 to 1970; librarians at St. Louis University (Mary Bires) and Creighton University (Shirley Hermanek, Mary Hunt, Lauralee Grabe, Lavina Swanek, James Kramper, S.J.), who gave valuable aid in obtaining books and periodicals; Mrs. Ann Wieberg and Robert Larson, who have been accurate and patient typists; my sister and cousin, Mrs. Elizabeth Koblitz and Alva Welsh, who efficiently helped with bibliography; Dr. Jude Dougherty, School of Philosophy, Catholic University of America, Washington, D.C., who provided assistance in the final preparation of the manuscript.

Special gratitude is also due to two sets of benefactors who are more remote and less personal but who have made signal contributions to *Infinity in the Presocratics*. The first is the American Council of Learned Societies, which awarded me a Fellowship for 1963-1964 on the topic, "Infinity in Proclus, Pseudo-Dionysius and *Liber de Causis*." It was while working under this Fellowship that I again became aware that infinity in

²⁸ Obviously, my coverage of secondary literature has been personal with regard to Anaximander and (to some extent) vicarious with regard to other Presocratics. Why the difference? Ideally, I should have personally covered as many studies as possible even on philosophers subsequent to Anaximander. Unless one has himself experienced the full extent and depth of relevant publications, he can hardly appreciate how widespread interest is in the early Greeks, how great the industry and talent (both philosophical and philological) of current scholars, how varied their approaches and how brilliant their insights, how disparate the conclusions they formulate. This last point of controversy in turn forces one to realize the necessity of constant reflection on the Greek texts, which in the end must control everything. But my situation was not ideal. I had a limited amount of time for tracking *to apeiron* through the first two centuries of Hellenic thought and a single volume within which to present the results. Consequently, I decided to compromise. I would personally try to cover all relevant literature on Anaximander since 1947 so as to gain the advantages just listed (hoping also to share them with my students and with other teachers and students by publishing my coverage). For the other Presocratics I would depend upon the reputable and relatively comprehensive surveys of Kirk-Raven and Guthrie, complemented at times by my own research.

Neoplatonists could not be adequately understood unless one went back to their predecessors, who include not only Plato and Aristotle but also the Presocratics. The second set consists of those brilliant and (the adjective is not too strong) heroic scholars who have published philological and philosophical studies on the Presocratics: Bollack, Burkert, Cherniss, DeVogel, Furley, Guthrie, Kahn, Kerferd, Kirk, Lloyd, Mondolfo, Owen, Owens, Philip, Raven, Solmsen, Tarán, Vlastos, Von Fritz . . . But enough names: to list them all would be to recite my bibliography. Suffice it to admit honestly and gratefully that the only way a newcomer to the study of the early Greek philosophers could write even a survey of their positions on infinity is to have relied constantly on such scholars.

CHAPTER I

SECONDARY LITERATURE ON ANAXIMANDER

Studying any question in the Presocratics presents serious difficulties, the major one of which is that we have so little trustworthy or easily attainable information on them. Only fragments of their treatises (in some cases no more than a single sentence) are extant as direct quotations in such subsequent authors as Plato, Aristotle, Plutarch, Sextus Empiricus, Clement of Alexandria, Hippolytus, Diogenes Laertius, John Stobaeus, and Simplicius. Other data comes to us from expositions given by later Greek philosophers – Plato and Aristotle again, as well as Theophrastus (who is himself greatly dependent on Aristotle) and the “doxographers.” These last record the opinions (*doxai*) of previous thinkers (which they derive almost entirely from Theophrastus), and among them are Aëtius, Sotion of Alexandria, Irenaeus, Apollodorus of Alexandria, Hippolytus, the author of Pseudo-Plutarchean *Stromateis*, Diogenes Laertius.¹ In using such expositions one must always contend with the possibility or, even, likelihood that Aristotle or whoever the expositor might be is interpreting and modifying rather than merely reporting the Presocratic doctrine at issue. If so, what one ends up with is not (say) Anaximander himself but Anaximander-as-viewed-by-Aristotle.² One safeguard is, of course, to check the exposition with the Presocratic’s own text, but this, as we have already mentioned, is frequently no longer extant to any degree.

¹ On the transmission of Presocratic treatises, see KR 1-7; Kahn, pp. 11-24; G, vol. I, xiii-xiv and 41-43; D. R. Dicks, “Thales,” *CQ*, n. s. 9 (1959), 294-309.

² On the difficulty of isolating the Presocratics’ own doctrine from that of Aristotle and other authors (especially Theophrastus) upon whom we depend as sources, see Harold Cherniss, *ACPP*, pp. ix-xiv and 347-404; J. B. McDiarmid, “Theophrastus on Presocratic Causes,” *HSCP*, 61 (1953), 85-156 (for instance, see p. 133: “With regard to the Presocratic causes at least, he [Theophrastus] is a thoroughly biased witness and is even less trustworthy than Aristotle”); Leonardo Tarán, pp. 269-95, especially p. 278: Aristotle “interprets the statements of his predecessors as if they were facing the same problem as he did; and so not only

This deficiency of adequate and authentic information has resulted in our having comparatively meager knowledge of Presocratic doctrines, and even that is largely conjectural and only probable. Their doctrines are also the center of intense and almost constant controversies among scholars, who from the few textual seeds of the Presocratics harvest a rich crop of learned articles and studies. Controversial and numerous as these are, though, we are advised that "more and more it is seen to be necessary [not only] to make a critical study of the whole of the ancient evidence . . . [but also] to assess it in relation to the ever-increasing body of modern critical discussions."³ Let us follow that advice as completely as possible in regard to Anaximander (ca. 610-546 B.C.), who comes at the very start of Greek philosophy. He introduced the term *apeiron* into philosophical circles and places infinity at the very center of his entire doctrine. Canvasing the past two decades of literature on him will not only help reveal his doctrine but will also be the occasion for suggesting a methodology for studying subsequent philosophers.

Let us first indicate the ancient sources on Anaximander with which contemporary scholars are concerned.

ANCIENT SOURCES

According to Paul Seligman, *The Apeiron of Anaximander*, the following three passages are the most significant statement of Anaximander's philosophical notions.⁴

I. Simplicius, *Commentary on Aristotle's Physics*, 24, 13, quoting from Theophrastus (DK 12A9; KR 105-107):

Of those who say that it [*archê*] is one, moving and infinite, Anaximander,

does he misinterpret their doctrines, but, what is even worse, he obliterates the problem which they tried to solve."

Unlike the severe and pessimistic attitude of those three scholars, the first three mentioned *supra*, note 1, do grant historical value to some of Aristotle's and Theophrastus' accounts, although simultaneously preserving a sanely critical view.

³ G. B. Kerferd, *CR*, n.s. 17 (1967), 13.

⁴ (London: University of London Athlone Press, 1963), p. 19.

The English translation of those passages is (with one exception) that found not in Seligman but in KR, which gives the Greek text for each and which also is more complete (e.g., Seligman [p. 20] gives only a single sentence from Hippolytus). The one exception is the translation of text III, which is taken from C. H. Kahn, who devoted a special article to it: "Anaximander and the Arguments Concerning the *Apeiron* at *Physics* 203b4-15" (for publishing data, see below, n. 21).

Here and elsewhere I shall transliterate necessary Greek words wherever conveniently possible rather than utilizing Greek type. When analyzing authors who

son of Praxiades, a Milesian, the successor and pupil of Thales, said that the principle and element of existing things was the *apeiron*, being the first to introduce this name. He says that it is neither water nor any other of the so-called elements, but some other *apeiron* nature, from which come into being all the heavens and the worlds in them. *And the source of coming-to-be for existing things is that into which destruction, too, happens according to necessity; for they pay penalty and retribution to each other for their injustice according to the assessment of Time*, as he describes it in these rather poetical terms.

II. Hippolytus, *Refutatio*, I. 6, 1 (DK 12A11; KR 105-107):

Now Anaximander was the disciple of Thales. Anaximander, son of Praxiades, of Miletus: . . . he said that the principle and element of existing things was the *apeiron*, being the first to use this name of the material principle. (In addition to this he said that motion was eternal, in which it results that the heavens come into being.) . . . He said that the material principle of existing things was some nature coming under the heading of the *apeiron*, from which come into being the heavens and the world in them. This nature is eternal and unaging and it also surrounds all the worlds.

III. Aristotle, *Physics*, 203b4-15 (DK 12A15; Kahn, *art. cit.*, pp. 21-22):

It is reasonable that all posit the Infinite [*to apeiron*] as a starting-point. For it could not be in vain, nor could it have any other power than that of starting-point. For everything either *is* a starting-point or derived *from* a starting-point. But there is no starting-point for the Infinite, since in that case it would have a limit.

Furthermore, the Infinite is ungenerated and imperishable, as [is reasonable on the grounds that] it is a starting-point. For what is generated must necessarily reach its conclusion, and there is an end to every act of perishing. Therefore, as we have said, there is no starting-point for this thing [i.e., the Infinite], but it seems rather to be the starting-point for the rest, and to encompass all things and to guide them all (as those say who do not set up other causes besides the infinite, such as Mind or Love) and to be the Divine; for it is immortal and uncorruptible, as Anaximander says and most of the natural philosophers.

The passages from Simplicius and Hippolytus are both versions of Theophrastus' account of Anaximander. In Simplicius' version the italicized sentence (either in its entirety or, at least, in its second clause – the point is controverted) is a direct quotation from Anaximander's own

themselves transliterate words, I shall use their versions, which disagree at times. For example, some transliterate ἀρχή as *arché*, others as *arche* or *archē*. (Incidentally, authors write the name of the doxographer, Aëtius, with and without diaeresis. When quoting or paraphrasing them, I shall conform to their spelling).

For biographical data on the Greek philosopher, see KR 99-101; G, vol. I, 72-76.

The Greek text used throughout this and subsequent chapters will often be that furnished by KR, who rely upon the text of DK (see KR, p. viii, for a rubric governing their references) and who provide reliable translations. Whenever we use translations other than KR, we provide a reference to their source and, if helpful or necessary, to the Greek text (e.g., DK, the Berlin edition of Simplicius, Ross's edition of Aristotle's *Physics* and *Metaphysics*, the Loeb edition of Aristotle's *On the Heavens*, and so on).

treatise and will be referred to in subsequent paragraphs as the “Fragment of Anaximander.” The passage from Aristotle occurs when the Stagirite is explaining why all philosophers of nature have made the infinite a principle and source.

Let me add some other passages, which are frequently mentioned in current literature.

IV. Aristotle, *ibid.*, 187a12 (KR 110):

Two types of explanation are given by the physicists. Those who have made the subsisting body one, either one of the three or something else which is thicker than fire and finer than air, generate the rest by condensation and rarefaction, making it into many But the others say that the opposites are separated out from the One, being present in it, as Anaximander says and all who say there are one and many, like Empedocles and Anaxagoras, for these, too, separate out the rest from the mixture.

V. Aristotle, *ibid.*, 204b22 (KR 112):

But yet, the infinite body cannot be one and simple, whether it be, as some say, that which is besides the elements, from which they generate the elements, or whether it be expressed simply. For there are some people who make what is beside the elements the infinite, and not air or water, so that the rest be not destroyed by their infinite substance; for the elements are opposed to each other (for example, air is cold, water moist, and fire hot) and if one of those were infinite the rest would already have been destroyed. But, as it is, they say that the infinite is different from these, and that they come into being from it.

VI. Aristotle, *De Generatione et Corruptione*, 332a19 (KR 110):

There is no one of these things [fire, air, water, earth] from which come all things; and certainly nothing else beside these, such as something half-way between air and water, or air and fire, being thicker than air and fire and finer than the others; for that will be air and fire, simply, together with contrariety; but one of the two opposites is a privation – so that it is impossible for the intermediate ever to exist in isolation, as some say the *apeiron* and the surrounding does.

VII. Simplicius, *Commentary on Aristotle's Physics*, 24, 21 [A continuation of Text I given above, although Simplicius is no longer quoting Theophrastus but giving his own paraphrase of what he has just quoted], (KR 129):

It is clear that he [Anaximander], seeing the changing of the four elements into each other, thought it right to make none of these the substratum, but something else beside these; and he produces coming-to-be not through the alteration of the elements, but by the separation off of the opposites through the eternal motion.

VIII. Ps.-Plutarch, *Stromateis* 2 (DK 12A10; KR 105-107, 131):

Anaximander, who was the companion of Thales, said that the *apeiron* contained the whole cause of the coming-to-be and destruction of the world, from which he says that the heavens are separated off, and in general all the worlds, being *apeirous* [innumerable]. He declared that destruction, and much earlier coming-to-be, happen from infinite ages, since they are all occurring in cycles He says that which is productive from the eternal [*to ek tou aidiou gonimon*] of hot and cold was separated off at the coming-to-be of this world, and that a kind of

sphere of flame from this was formed round the air surrounding the earth, like bark round a tree. When this was broken off and shut off in certain circles, the sun and the moon and the stars were formed.

These last five excerpts, when added to the previous three, are among the main expressions of Anaximander's philosophy. How do scholars interpret them? What sort of infinity do they find expressed there?

RECENT STUDIES ON ANAXIMANDER

Even when we restrict ourselves to the past twenty years, we find more than twenty noteworthy investigations of Anaximander's position.

Vlastos, Jaeger, Burch, Kraus

In 1947 Gregory Vlastos began his essay, "Equality and Justice in Early Greek Cosmologies,"⁵ by studying medical writers (e.g., Alcmaeon, Hippocrates), Empedocles and Parmenides because he was convinced that "their thought-forms are safer guides to Anaximander than are the categories of Aristotelian physics" (p. 168).⁶ This study led him to reject the traditional interpretation of the Fragment of Anaximander (see above, text I), according to which "the very existence of the cosmos is itself an injustice against the Boundless [Vlastos' translation of *to apeiron*], to be expiated by reabsorption" (pp. 169-70). No, the victim of injustice is not the Boundless: the opposites (hot and cold, dry and moist, and so on), which are the main components in Anaximander's cosmology, encroach upon one another and "injustice" results. But when the world is, in due course, reabsorbed into the Boundless, which is itself a state of dynamic equilibrium, the opposites

are blended once again, and their equilibrium is perfectly restored. And this must entail a process of "reparation," where unjust gains are disgorged and unjust losses fully made up. Thus at no time is there either injustice against the Boundless or reparation to it. Reabsorption into the Boundless is only the process which insures full reparation among the opposites themselves; the damages are paid not to the Boundless but to *one another* (p. 172).⁷

⁵ *CP*, 42 (1947), 156-78.

⁶ So as to cut down on footnotes, page references will be given (as here) within the main body of the text whenever possible.

⁷ For Vlastos' commendation of Anaximander, see *ibid.*, p. 173. For additional information, see *idem*, *Gnomon*, 27 (1955), 74-5 and note 2.

In the same year Werner Jaeger also published his Gifford Lectures (which had been delivered in a much briefer form eleven years previously) in a book entitled *The Theology of the Early Greek Philosophers*,⁸ the second chapter of which is given over mainly to Anaximander (pp. 23-37). As seen by Jaeger, Anaximander's Boundless (*to apeiron*) is most meaningfully conceived precisely as boundlessness. It is the "endless, inexhaustible reservoir or stock from which all Becoming draws its nourishment, not that which is qualitatively undetermined, as certain modern writers have described it" (p. 24). Against J. Burnet, the German philologist deems it to be "far more likely that Hippolytus and Simplicius, following Theophrastus himself, both agreed in holding that Anaximander was the first to use the word *arché*," although in a sense different from Aristotle's (p. 27). Moreover, Anaximander is the first to apply the concept of the Divine (*to theion* in contrast with *ho theos*) to the first principle of Being, since the Boundless is "unborn and imperishable, all-encompassing and all-governing" (p. 31; also p. 203-206, n. 44). Jaeger takes seriously the tradition that Anaximander believed in innumerable worlds, and "apparently this belief involved not only an infinite succession of worlds in time, but also the simultaneous existence of innumerable worlds or heavens" (p. 33). The entire last sentence of Simplicius' text (quoted above in text I) is unquestionably Anaximander's own words (p. 34). Against Nietzsche and Rohde but with Burnet, Jaeger interprets that sentence as meaning that things pay penalty not to the Boundless but to one another: "When Anaximander proposes this image [paying penalty, making atonement for injustice] as an explanation of the coming-to-be and passing-away of things in the natural world, he is obviously thinking of their very existence as dependent on a state of having-too-much, for which they must make amends by ceding to others the things they now enjoy" (p. 35).

In 1949 George Burch's article, "Anaximander, the First Metaphysician,"⁹ depicted eight important concepts the Greek thinker contributed to philosophy, of which "four are metaphysical; one is ethical; two are cosmological; and one is psychological" (p. 141). Let us restrict ourselves to reviewing the metaphysical and ethical notions. In agreement with Jaeger, Burch finds Anaximander introducing "into philosophy the concept of God in the philosophical sense Its introduction can be

⁸ Oxford: Clarendon Press, 1947.

For an appreciative but somewhat dissenting reaction, see G. Vlastos, "Theology and Philosophy in Early Greek Thought," *PQ*, 2 (1952), 92-132; especially see p. 113: "There is no good evidence that either Anaximander or Anaxagoras called their cosmogonic principle 'god' or even 'divine'."

⁹ *RM*, 3 (1949), 137-60.

considered the beginning of the history of metaphysics" (*ibid.*). God is the Indefinite (*to apeiron*) – a predicate which implies Him to be not only spatially infinite (the meaning to which Burnet would restrict the term) but also qualitatively indefinite: He is without any definable attribute whatsoever, He is neither a thing nor any sort of thing (Burch here finds Anaximander anticipating the "negative theology" of Pseudo-Dionysius and other Christian writers of the patristic period; pp. 142-44). The Indefinite God is both the origin and the terminus of the universe. It originates through an emanation (literally, a "separating from" or "separating out of"), which is due to the Indefinite's eternal motion. What immediately emanates is the "opposites" (hot/cold, etc.). Since emanation is the origin of things not from other things but from non-thing and is not a physical process at all, Anaximander's doctrine is not a physics but a metaphysics. In contrast with Anaxagoras and Plato, who think that God makes the world by imposing order on a preexisting chaotic matter, Anaximander believes that before the event of emanation there exists not God and chaos but "only God (the indefinite), and therefore he is the sole cause . . . , both sufficient and necessary, of the universe" (p. 145). The universe also reverts to the indefinite deity. Things return to God by their destruction, just as their emanation is their production. The couplet, "production-destruction," suggests an infinite series of worlds, which would seem to mean a temporal succession of cosmic cycles: possibly "the universe as a whole is destroyed, and then, after an intervening period during which nothing but the indefinite exists, a new universe emanates, to be destroyed in its turn, and so on forever" (p. 147). Finally, in the so-called Fragment Anaximander introduces into Greek philosophy the concept of natural law, which is both scientific (because applying universally and inevitably) and moral (because based on an "injustice," which deserves punishment). What our Presocratic author is trying to express is that

existence as a definite being is itself unjust. We are encroaching on each other by our existence. Injustice is lacking only in the eternal indefinite . . . In the temporal world of definite beings, we compete for place. This unjust encroachment calls for retribution. We can atone for our coming into existence only by passing out of existence again, and the eternal law assures that we do so (pp. 148-49).

A German scholar, Walther Kraus, opened his 1950 study, "Das Wesen des Unendlichen bei Anaximander,"¹⁰ by pointing to the general agreement among scholars that "Anaximander's infinite is not material in any real sense" (p. 364). After allocating imperishability (*Unvergänglichkeit*) as a

¹⁰ *RhM*, 93 (1950), 364-79.

property to *Das Unendliche* and reconciling apparently contradictory statements of Aristotle and Aëtius and after discussing passages in which Aristotle might seem to describe Anaximander's infinity as a substance between such elements as fire and air (pp. 366-77), Kraus takes pains to emphasize that Anaximander's concept of substance is far separated from Aristotle's. In the course of his remarks he turns to the Fragment of Anaximander. He is primarily interested in its first clause, which he translates as: "Das Unerschöpfliche, woraus alles wird und wohin es wieder vergeht." This, he comments, is thought by some to be Anaximander's own words. Not so – in fact, it is even foreign to his thought and is actually a peripatetic gloss (p. 377). Kraus concludes his article by returning to the Infinite's transcendence of matter. *Das Unendliche* is not any sort of matter in which each part is like the whole. It is not some sort of stuff from which the world is constituted. It is rather the eternal primordial source of all being and produces world after world from an inexhaustible fecundity.

Für Anaximander aber war das Unendliche keine Materie, von der jeder Teil mit dem Ganzen gleichartig ist, kein Stoff, aus dem die Welt besteht, sondern der ewige Urquell alles Seins, der in unerschöpflicher Fruchtbarkeit Welten um Welten erzeugt.

This productive process is not physical but metaphysical in nature and is viewed in a mythical-biological fashion. Above all, the process is not reversible. What now comes into being will eventually disappear absolutely, and something completely new will take its place. Back of all the infinite multiplicity of what comes and goes there stands the Transcendent who is immortal, imperishable, eternal and inexhaustible (p. 378).

Cherniss, Cornford, Matson, McDiarmid

In a lecture given in 1948 but not published until 1951,¹¹ Harold Cherniss challenged W. Jaeger's contention seen above that "there is a deep religious significance in Anaximander's conception... and that his system is in fact a theology, theogony, and theodicy in one. This is a conclusion which is at the very least unwarranted, even if Anaximander did say that what is divine is his *apeiron*, which is far from assured by the evidence." For one thing his Unlimited is not "conscious or personal and,

¹¹ "The Characteristics and Effects of Presocratic Philosophy," *JHI*, 12 (1951), 319-45. The section on Anaximander runs from p. 323 to p. 329. Also see his *ACPP*, pp. 375-79.

if it guides all things, it does so in no voluntary sense" (pp. 326-27). What, then, is Anaximander's Unlimited? It is "not a single unqualified substance from which entities are developed by qualitative change," since the distinction of quality and substance or the notion of alteration had not even occurred to Anaximander (p. 324). Nor is it, as Theophrastus would have it, an *arché* in the sense of an Aristotelian "principle" – as though it were similar to Aristotle's "prime matter as the substrate which is the indeterminate potentiality of all the properties, none of which it has actually" (p. 325). Nor is it, as some moderns would want, like Hesiod's chaos, which is a mere yawning emptiness instead of a reservoir which is full, positive and active through continual self-motion (p. 326). Rather, Anaximander's Unlimited is a "boundless expanse of indefinitely different ingredients so thoroughly mixed together as to be severally indiscernible in the mixture but which when segregated from the mixture are recognizable as all the differences of an articulated world." In describing his *arché* as *to apeiron*, the Greek philosopher did not intend "that limitlessness or infinity exhausts its nature but that it is unlimited without restriction, unlimited in every sense of the Greek word, in extent, in multitude, and in kind, in short not that it is *potentially* everything being *actually* nothing but infinity, as the Peripatetic interpretation would have it, but that it is everything *in actuality*" (pp. 324-25). The innumerable worlds, which arise through separation from the Unlimited, also "are reabsorbed by it 'as needs must be,' and Anaximander envisaged this repeated process as a settling and resettling of accounts among the ingredients of the *apeiron* which by being reabsorbed into the common mixture make amends and requital to one another for injustice done 'in the fixed order of time.' This is according to him the law of all nature . . . [And] this conception of nature as an all-inclusive system ordered by immanent law was Anaximander's most important legacy to subsequent thought." His preoccupation with nature also shows him to be a cosmologist and not a theologian (p. 327).

The question which F. M. Cornford asked in *Principium Sapientiae: The Origins of Greek Philosophical Thought*, published posthumously by Cambridge University Press in 1952, is both valuable and difficult: did the Ionian philosophers use direct methods of observation of facts, generalization and experiment in elaborating their philosophical theories? Or were they dogmatic structures based on *a priori* premises inherited from mythical and poetical cosmogonists who had preceded them (pp. 10-11)? By the middle of the book this question was directed to Anaximander, whose system "set the pattern followed throughout the later course of Ionian speculation." As far as he is concerned, the answer to the inquiry

is that Ionian philosophy was not primarily scientific. It was not "the work of rational inference based on observation and checked by at least rudimentary methods of experiment" (p. 186). Rather, this was a "scheme of cosmogony already provided by Hesiod and other poetical cosmogonies. He took the final step in the process of rationalization, divesting the scheme of the last traces of mythical imagery." Accordingly, "the pattern of Ionian cosmogony, for all its appearance of complete rationalism, is not a free construction of the intellect reasoning from direct observation of the existing world" (pp. 200 and 201).¹²

In working out that answer Cornford gives a good deal of information on Anaximander's *to apeiron*. Against Burnet and in agreement with Simplicius who is quoting Theophrastus ("the only authors who had read Anaximander's book . . . if we reject [their] testimony, we had better admit that we know nothing about him"; p. 161, n.2), Cornford holds that the Boundless is the initial state (and, thus, an *arché*), a primitive fusion, an indistinct unity in which the opposites (heat, cold, moist, dry) are initially contained and from which they emerge by separating out into distinctness so as to take up their appointed stations in the world (pp. 161-64). Actually, Aristotle has suggested six meanings for *to apeiron*. 1) It is that which has no beginning or source and, therefore, is the source from which all limited things come and into which they return (p. 173). 2) It is inexhaustible inasmuch as it "is never used up in the process of generating the limited things 'separated off' from it: there is always more in the reservoir. A strictly infinite quantity is, however, not required. When a world perishes, its materials return into the reservoir and go to form another, successive, world" (*ibid.*). 3) It has no beginning or end in time, in contrast with individual things in the world (pp. 173-74). 4) Because it encompasses all things and contains them within itself, it itself has nothing beyond to limit it (as do the opposites, which limit one another) and, thus, is unlimited (pp. 174-76). 5) Although immense in mass (yet not strictly infinite in extension), it is a sphere in shape, which is "unlimited" because everywhere uniform, without beginning or end, embracing all things within (pp. 176-78). 6) It has no internal boundaries and distinctions since the opposites present within are indistinct from each other and from it: there is no boundary where the Hot ends and the Cold begins. They are fused like wine and water in the same glass, which are

¹² George Thomson finds Cornford's thesis confirmed by the fact that "the cosmogony of Hesiod and the cosmology of Anaximander are offshoots of a Minoan hieratic tradition, which reached Greece from the East." See his "From Religion to Philosophy." *JHS*, 73 (1953), 77-83, especially p. 79.

different but not separate (p. 178). Anaximander's *to apeiron* has all those meanings. There are, in fact, only two negative significations one may not apply to it – that it is spatially infinite in extent and, secondly, that it is qualitatively indeterminate as is “Aristotle's ultimate matter, an abstraction considered as not yet endowed with the four primary qualities, hot, cold, wet and dry. Anaximander's opposites are not qualities, but things,” which are present in the Unlimited stuff but not as distinct (*ibid.*).

The ultimate source has positive properties too. It is divine and, therefore, living and, therefore, self-moving and this eternally. Because it guides, steers, governs all things, it is also endowed with some sort and degree of consciousness (pp. 178-79). In fact, “we may say that [Anaximander's divine stuff] contains implicitly the moving cause which emerges explicitly in Anaxagoras' Intelligence, a unique substance extended in space and yet knowing and controlling all things and capable of starting the cosmic revolution” (p. 179). Anaximander does not, though, anticipate the Atomists' conception of co-existent “innumerable worlds, scattered throughout infinite space, and passing into and out of existence,” despite what some modern historians say (pp. 177-78).

A final point which Cornford makes several times: the injustice and penalty spoken of in the Fragment of Anaximander have reference to the conflict between the opposites taken as seasons of the year. Hot, cold, dry and moist are equivalent to Summer, Winter, Spring and Fall. One season “advances, in ‘unjust’ aggression, at the expense of its contrary, and then pays the penalty, retreating before the counter-aggression of its [own] antagonist. Thus in the whole cycle the balance of justice is maintained” (p. 168; also see pp. 171, 183).

Appearing a year after Cornford's book, W. I. Matson's article, “The Naturalism of Anaximander,” attacked Jaeger's and Burch's contention that the Greek author is theologian *par excellence*.¹³ Defending Burnet's view that “there is no trace of theological speculation” in the philosophy of the Milesians, Matson finds Anaximander to be “certainly a natural scientist and a great one . . . If he was a theologian at all, it was only on a part-time basis” (pp. 388-89). Why so? For three reasons. “Hesiod represents the real theology of that time, and one cannot think of two Greeks further apart than Hesiod and Anaximander. Anaximander's speculation was not only discontinuous with all mythologizing, but in direct opposition to it both in method and result” (p. 392). The so-called Divinity he postulates is uncreated, ageless and deathless – attributes which do not have much appeal to any religious sentiment. Secondly, Anaximander uses

¹³ *RM*, 6 (1953), 387-95.

logic not intuition as his weapon in hunting down the unchanging Ground of changing appearance and, thus, is a metaphysician and not a religious enthusiast. The Ground finally captured "lacks the crucial characteristics that really Divine Grounds always have. The particular things that separated out are . . . differentiated on account of its 'eternal motion' – a property, by the way, which *this* Ground and no Divine Ground has" (p. 393). Thirdly, it is very doubtful that the Fragment of Anaximander as reported by Simplicius quoting Theophrastus expresses Anaximander's literal view. But even so, the retribution mentioned is not "necessitated by the nature of the Boundless which 'steers all things'." It is merely the natural way of saying "that nothing in Nature ever gets the upper hand and keeps it . . . Just as a well-ordered government sees that theft is punished, so the order of Nature is such that no considerable imbalance can last indefinitely" (pp. 394-95). Matson's conclusion is that Anaximander is a religious thinker only if one grants the content of his religion to be physical speculation. Rather than a theologian, he is "the first great metaphysician and natural scientist . . . He is the first out-and-out Naturalist in Western culture and only Democritus rivalled the sublimity of his philosophy" (p. 395).

Under the impact of Cherniss's contention that "Aristotle's accounts of earlier doctrines are so inextricably bound up with arguments for his own doctrine that history cannot be easily distinguished from interpretation," John B. McDiarmid in 1953 wrote an incisive and well documented article, "Theophrastus on the Presocratic Causes," in which he investigated the relation of Theophrastus' *Physical Opinions* to Aristotle on the topic of causes.¹⁴ His conclusions were somber and sobering. "Theophrastus' treatment of Presocratic causes owes not only its general point of view but also much of the detail of its organization and wording to the *Metaphysics* [Book] A summary, and . . . his departures from that summary are usually only for the purpose of gathering additional material from Aristotle's other accounts and from the works of the Presocratics" (p. 129). That Theophrastus did make use of the original writings of the Presocratics is supported "by his quotations from almost all the major Presocratics after Thales. The texts of the Presocratics are, however, no protection against the influence of Aristotle, for in almost every instance the meaning of the quotation is distorted in order to yield proof of an Aristotelian interpretation that is clearly impossible" (pp. 132-33). One must realize that "by his method of selection and adaptation he has frequently misrepresented his source and has exaggerated the faults present in it. It must be

¹⁴ *HSCP*, 61 (1953), 85-156.

concluded that, with regard to the Presocratic causes at least, he is a thoroughly biased witness and is even less trustworthy than Aristotle" (p. 133).

McDiarmid establishes those conclusions by studying (among others) Anaximander (pp. 96-102 with notes), about whom he makes several important points. The notion of circular change (namely, things are generated from and destroyed into one and the same principle) is not unique to Anaximander but is common to all the Ionian philosophers (pp. 97-98). Secondly, the metaphor in the Fragment of Anaximander ("they make reparation and satisfaction to each other for their injustice") does not refer to the process of generation and destruction, by which "things in general, including the heavens and the worlds in them" emerge from and return to the Infinite, but to "things of a special sort, things that are opposed and that wrong each other" – namely, what Theophrastus erroneously (because an anachronism) calls the four "elements" but which actually are infinitesimal particles of things (p. 98). Next, the metaphor aims at justifying Anaximander's doctrine "against Thales and any one else who made one of the opposed elements the primordial matter." That is to say, the primal substrate must be other than the elements (to continue using Theophrastus' word) and this is precisely the Infinite. If, as Aristotle made clear, one of the elements themselves "were the Infinite, the other elements could no longer restrain its injustice by compelling it to pay retribution, and they would, consequently, be destroyed by it" (pp. 98-99). Fourthly, Aristotle's assumption, shared by Theophrastus, that Anaximander subscribed to the genesis of the four elements through the interaction of the contraries on undifferentiated matter, wherein they were potentially present, is historically wrong. Generation for Anaximander was not a qualitative change of matter but the separation of contraries due to eternal motion (pp. 99-100). His *apeiron* was not Aristotle's prime matter at all but a mixture

which was an aggregate of infinitesimal particles of things... If Anaximander did speak of inherence in the mixture, then, he meant the inherence of actually existent things and not the inherence of anything like the Aristotelian contraries. If he referred to the Infinite in language that would suggest to the Peripatetics an indeterminate substance, he meant simply that in the Infinite no one thing so predominates as to give the Infinite any one definite character (p. 101).¹⁵

¹⁵ Although McDiarmid takes the same pejorative view on Aristotle and Theophrastus as Cherniss, he does differ with him on occasion. For example, Cherniss (*ACPP*, pp. 376-77) sees in the use of the plurals (*ὄν* and *ταῦτα*) in the Fragment of Anaximander evidence that Theophrastus knew that the Infinite was a multitude of bodies and not a single entity. But McDiarmid affirms that "the plurals cannot

Finally, the positive historical value which the accounts of Aristotle and Theophrastus have is reduced to two points. Anaximander's doctrine was, actually, more closely related to that of Anaxagoras and Empedocles than to the view of the monists; his position was to some degree a pluralism. Since his particles may possibly be like Anaxagoras' homoeomeries, the ingredients of the Infinite can hardly be contraries (pp. 101-102).

Hölscher, Kirk

In the first installment of a long and erudite article, "Anaximander und die Anfänge der Philosophie," Uvo Hölscher takes a stand on several controverted passages relevant to Anaximander in Simplicius, Theophrastus, Aristotle, Pseudo-Plutarch and others.¹⁶ Simplicius, *In Physicorum*, 150, 24 ("the opposites are hot, cold, dry, moist and other such factors") does not give valid testimony on Anaximander's own doctrine (vs. Diels, Zeller, Deichgräber; pp. 257-58). In *ibid.*, 24, 21-25 (see above, text VII), Simplicius is no longer reproducing Theophrastus' report of Anaximander's doctrine but is speaking for himself and expressing an Aristotelian rather than an Anaximandrian theory (pp. 258-59). The eternal motion mentioned in *ibid.*, lines 24-25 ("the separation off of the opposites through eternal motion") may perhaps be taken from Theophrastus, who however did not intend it to be a "separating out" (pp. 259-60). In *Physics*, 187a20 sq. (see above, text IV) Aristotle mentions not just Anaximander but Empedocles and Anaxagoras as well. In fact, Aristotle is most directly concerned with these last two (for example, see the special criticism he gives of Anaxagoras, beginning with line 26), and mentions Anaximander only because of what he held in common with the other two: "separation out." But his process pertained to the world, theirs to the opposites (pp. 261-62). We have here an example of *eine Verallgemeinerung des Aristoteles* – namely, *er die Lehre von der Scheidung der Gegensätze von demjenigen, der sie am reinsten ausgesprochen hat, auf die ganze Gruppe der Ekkrisis überträgt* (p. 262).

Re: Physics, 187a23 ("these, too, separate out the rest from the mixture"), together with *Metaphysics*, 1069b20: Anaximander's *apeiron* is not a mixture, which is a fitting description only for Empedocles' and Anaxagoras' primal stuff. Simplicius' verdict (*In Physicorum*, 24, 25 and

have this significance. Probably they have no special significance at all" (p. 141, n. 57).

¹⁶ *Hermes*, 81 (1953), 257-77.

154, 14) is significant: Aristotle makes Anaximander be a pluralist, Theophrastus makes Anaxagoras be a monist (pp. 262-64). *Re* Pseudo-Plutarch, *Stromateis* 2 (quoted above, text VIII, last two sentences): despite many obscurities in the text itself, its meaning is a sufficiently literal summary of Theophrastus and, thereby, a reasonably authentic reproduction of Anaximander's thought (p. 267). One textual obscurity there encountered is *to gonimon*, which one might translate as "germ" or "embryo" (*der Keim*) but which grammatically means "generative power" (*die Zeugungskraft*; p. 265). At any rate, the process by which *to gonimon* of hot and cold was separated off from the eternal is not mechanical (as in Anaxagoras or in Democritus) but spontaneous and possibly vital (pp. 266-67). *Re*: Simplicius, *In Physicorum*, 24, 18 (quoted above as text I, the last sentence of which is the "Fragment of Anaximander"): the law which demands that penalty be paid for injustice governs the coming-about and the passing-away of worlds and their *cosmoi*, as well as the transition from day to night and from summer to winter. But it does not pertain to terrestrial things (pp. 269-71). Theophrastus' opposites of hot-cold have no place precisely as opposites in Anaximander's world-view, which centers on three factors: earth, sea and fire (pp. 272-73). Nor does Anaximander consider the *apeiron* as intermediate between two opposites (*vs.* Gigon; pp. 274-75). He gives a prominent place to moistness (*das Feuchte*) in his cosmogony: the generative power which separates off from the *apeiron* is primal moistness, from which fire develops. If one would conceive the *apeiron* itself as vapor, then the emergence of the primal moistness from vapor would be through condensation. The result: a realization of how close Anaximander and Anaximenes are in their basic conception (pp. 275-76).

The second installment of Hölscher's article is not only longer (pp. 385-418) than the first but it also is more erudite with its constant and deep incursions into the religions of Greece, Babylonia, Egypt, the Hittites and Phoenicia, as well as into the Old Testament. His aim is to locate the forerunners of Anaximander's *to apeiron*. After seeking the sources for Thales' view that "the earth floats on water" (which turn out to be the peoples of the eastern Mediterranean regions, especially Egypt; pp. 385-90), he investigates Hesiod at length (319-413) as a possible intellectual ancestor of Anaximander. But Hesiod's own cosmogony is incomplete. Moreover, his story of the transmission of primacy from one god to another is itself based on a much older Hittite version. Possibly, though, both his and the Hittite story have a common source (pp. 391-92): a Phoenician theogony composed by Sanchuniaton and recounted by Philo

of Byblos (pp. 392-97). In Hesiod Chaos and Eros are among the primordial sources but they are viewed not so much cosmologically as morally (pp. 397-98). The word, "chaos," means "yawn" or "gape" and should not be applied to the space between sky and earth (pp. 399-400). Rather, Chaos points to what is below, to the depths (pp. 400-401). After a minute examination of Kronos, Okeanos, Zeus, Tartarus, etc. (pp. 401-411), Hölscher repeats his conclusion that Hesiod is less a cosmologist than a moralist. In fact, his *Theogony* is like the prophetic literature of an Ezekiel or a Jeremiah. Like a priest he expresses the truth communicated to him by the gods (pp. 411-413).

If Hesiod is influenced by the East, so too is Anaximander, as is indicated by some of his scientific achievements: a sphere or map of the heavens, a map of the earth, a sun-dial, and so on (pp. 415-16). But his cosmogony provides indications too. To give one instance: according to Anaximenes' world-view there comes forth from the primordial source (air) an initial product (earth), whence come the heavenly bodies (here the Greek author's view runs parallel to Sanchuniaton; see pp. 413-14). Likewise in Anaximander's view there comes forth from the *apeiron* a primordial moistness, from which develops the sphere of flame and, eventually, the entire universe (pp. 416-17; incidentally, it is doubtful that he posited innumerable worlds: p. 415, n. 5). His conception itself of the Boundless (*das Unbegrenzte*) lies in a tradition stretching back not to Hesiod's Chaos (which stems from the same root as does *to apeiron*) but to the oriental notion of "endless depths" (*unendliche Tiefe*), coupled with that of "the encompassing" (*das Umfassende*). Hence, the notion of the "Boundless" has appeared previous to Anaximander in many different guises.

Der Begriff des Unbegrenzten ist dort überall mitgedacht, und je in verschiedener Weise: bei Sanchuniaton als das, dem noch keine Grenze gesetzt ist; im Alten Testament als unendliche Tiefe und Quell des Segens; in Babylon als ungeheurere Urmutter, unerschöpflich an Geburten; in Ägypten als allumfassender Ursprung und ältester Gott. Es ist aber deutlich, dass sich in allen Abwandlungen eine Grundkonzeption vom Ursprung erhält und nur je verschiedene Seiten vorgeht (p. 174).

Anaximander's view of *to apeiron* is multifaceted: it joins together in that primordial *arché* productive power, inexhaustibility, and divinity. What gives that view a properly philosophical character is its intellectuality (*Begrifflichkeit*; p. 418). It has arisen from genuine intellection, it is definitely an intellectual conception, an authentic intelligibility. Despite its philosophical nature, though, his *arché* derives from oriental myths its

essential features -- namely, power, religious value and notional vitality (*ibid.*).

In 1955 G. S. Kirk attempted in the *Classical Quarterly* to answer "four almost classic problems in Anaximander."¹⁷ Problem One: Did Anaximander describe his *to apeiron* as *arché*? Kirk agrees with Burnet and McDiarmid that the relevant words of Simplicius (see above, text I) mean Anaximander was the first to call his material principle *to apeiron* and not that he was the first technically to apply *arché* to his originaive substance (pp. 21-24). Problem Two: Did Aristotle mean Anaximander when he referred to people who posited an intermediate substance? With Alexander of Aphrodisia, Simplicius, and (more recently) Burnet and Joachim, Kirk replies that in some at least of the nine places in which Aristotle mentions intermediate substance he is referring to Anaximander (pp. 24-25), who also is responsible indirectly for the origin of the notion.

The idea of intermediate substances surely arose in the first instance out of Aristotle's obvious bewilderment at Anaximander's concept of an originaive material qualified only as *apeiron* (which Aristotle took to mean, primarily, spatially infinite), and as divine and all-encompassing. Himself committed to the four simple bodies and to the theory of change as between opposites, and accepting "the elements" as the key-note of primitive physics, Aristotle normally assumed that Anaximander must have meant his *apeiron* to have *some* relation to one or more of the *stoicheia* -- especially since it evidently gave rise to the opposites (p. 25).

In those nine places where intermediate substance is mentioned, though, Aristotle did not always have historical cases in mind. Accordingly, "intermediate substance" is "a rather vague formulation by Aristotle which, though in the first place applied to Anaximander, is often repeated with no thought of him in mind and merely to satisfy Aristotle's own requirement of exhaustivity" (p. 28).

Problem Three: Innumerable Worlds. Anaximander does not posit innumerable worlds, either coexistent (*contra* Burnet) or successive (*contra* Zeller). An early Ionian thinker's aim was "to explain our world and account for its coherence. This necessitated, as it seemed to the Milesians, the description of a cosmic evolution from a single kind of matter. It did *not* necessitate the irrelevant and bizarre hypothesis of the world disappearing again into that same kind of matter" (p. 29). Anaximander may likely have spoken of past or future periods of drastic physical alterations of our world (thereby misleading the doxographers into ascrib-

¹⁷ "Some Problems in Anaximander," *CQ*, n.s. 5 (1955), 21-38.

ing the theory of innumerable worlds to him) – for example, catastrophes by extensive fire or flood (p. 30).

Problem Four: The extent and implication of the extant fragment. In opposition to Cornford, Jaeger and Kranz and in agreement with Burnet and Heidel, Kirk thinks it likely that the clause, “The source of coming-to-be for existing things is that into which destruction, too, happens,” is not Anaximander’s own words (p. 32). “According to necessity,” though, probably is Anaximander’s, as is “according to assessment of time” (pp. 32-33, 35-36). The clause, “they pay penalty and retribution to each other for their injustice,” does not refer to the world and the Boundless but to “the opposed world-masses of (primarily) the predominantly hot stuffs and the predominantly cold stuffs, the wet and the dry, the first pair of which Theophrastus . . . said were *somehow* produced from the Boundless at the beginning of the world.” The fragment means, then,

that cosmological events are maintained by a fluctuating balance of power between opposed masses. The legalistic metaphor of excess and deprivation . . . accounts not only for the *balance* of natural cycles like day-night, winter-summer, heat-cold, perhaps great winter-great summer, it also explains the *continuity* of these cycles by providing a metaphorical, anthropomorphic motive for action and reaction (pp. 33-34).

One should note that, although Anaximander implies the Boundless to somehow contain the opposites, he does not explicitly make the point because such containment “is contrary to the whole conception of *to apeiron*, which is presumably so called just because its nature cannot be properly defined” (pp. 34-35). In a final section Kirk asks why Theophrastus erred in interpreting Anaximander. One basic reason, at least, is that it is doubtful that Theophrastus had access to Anaximander’s own treatise. What he “might have had in front of him was not a complete book but a collection of extracts, in which emphasis was laid upon astronomy, meteorology, and anthropogony rather than upon the nature and significance of *to apeiron*, which might always have seemed confusing The extant fragment could be quoted by Theophrastus, of course, because it really came among the cosmological-meteorological extracts” (p. 38).

Two years after the publication of the fore-mentioned article and in collaboration with J. E. Raven, Kirk brought out a comprehensive and balanced book, *The Presocratic Philosophers: A Critical History with a Selection of Texts*.¹⁸ The section on Anaximander (pp. 99-142) is a

¹⁸ Cambridge: University Press, 1957. The book had been reprinted with corrections several times. Also see G. S. Kirk, “Sense and Common-sense in Greek

thorough and careful study. Besides the four classic problems investigated in his previous article, he discusses Anaximander's date, book and scientific activities; the nature of Anaximander's originative substance, the Indefinite; cosmogony; cosmology; the present structure of the world; zoogony and anthropogony. The solutions Kirk offers for the four classic problems remain pretty much the same as in his earlier article. Let us here isolate solely how he conceives *to apeiron*.

Although Aristotle and Theophrastus took "*apeiron* in Anaximander . . . to mean primarily 'spatially infinite'," it is uncertain that Anaximander himself intended it as precisely "the spatially infinite," a sophisticated notion not explicitly formulated before Melissus and Zeno. He did, though, assume the original stuff to have been indefinitely huge in extent, which he expressed by depicting it as "surrounding all things." Cornford and others "have argued that *to apeiron* meant 'that which is internally unbounded, without internal distinctions,' i.e., that which is indistinct, indefinite in kind." If we omit "internal," their argument appears probable, since "for Anaximander the original world-forming stuff was indefinite, it resembled no one kind of matter in the developed world" (pp. 108-109). In summary, then:

Either *to apeiron* meant "the spatially indefinite," and was implied to be indefinite in kind because it was not formally identified as fire, air, water or earth . . .; or Anaximander intended it to mean primarily "that which is indefinite in kind," but naturally assumed it also to be of unlimited extent and duration – properties which, when expressed, would be expressed in terms of all-inclusiveness and divine immortality (pp. 109-110).

The Indefinite, which is divine because immortal and indestructible, also surrounds and steers all things, thereby seeming to control them. What manner of control it exercises is not clear. Likely enough, the Indefinite controls things not by being immanent in them but "by its having initiated the world in such a way as to provide a continuing rule or law of change." This is "the law of retribution between opposites, a law (or manner of behaviour) which was initiated when the first opposed substances appeared within the Indefinite and which still governs all change in the world." Possibly, too, some sort of purposeful activity is attributable to the Indefinite (pp. 115-16).

Philosophy," *JHS*, 81 (1961), 105-177 (see p. 107: Anaximander's *apeiron* is "the first philosophical recourse to an unseen *arche* completely outside our experience").

Wiśniewski, Kahn

The year 1957 also saw appear Bohdan Wiśniewski's article, "Sur la signification de l'*apeiron* d'Anaximandre," in which he faced three problems.¹⁹ Is *to apeiron* a mixture of different elements or, rather, something intermediate between air and water? Is it spatially finite or infinite? Is it qualitatively determined or undetermined? In view of the contradictions and confusion in the Greek texts on Anaximander, Wiśniewski based his answers to those inquiries on a single hypothesis: there is nothing in the mind which has not been put there by experience (*il n'y a rien dans l'esprit qui n'ait été imposé par l'expérience*; p. 55). Accordingly, since Anaximander could have observed how a mixture of grains differing in weight is separated by the rotatory motion of what contains them (the heavier kernels remain in the center, the lighter ones move to the outside), it is probable that he considered *to apeiron* as a mixture. The idea of it as an intermediate substance would be improbable and incomprehensible, since he would not have experienced an example of such a thing (*l'entourage en effet ne lui fournissait pas d'exemple de ce genre*; *ibid.* and p. 51). It is, however, qualitatively indefinite, a condition which Anaximander could have realized by observing a seed, which is relatively simple and undifferentiated and yet produces a plant with many different and complicated organisms. Or an egg, from which a baby chicken comes which in turn grows into a hen, which too lays eggs and the cycle commences again. From such a concrete instance Anaximander could have become aware of an *apeiron* as qualitatively indeterminate from which develop endless cycles of worlds through endless time (pp. 53-55).²⁰

In 1958 Charles H. Kahn published a study on an important passage which Aristotle wrote establishing that the Infinite is an *arché*: *Physics*, 203b4-14.²¹ Is the doctrine Aristotle expresses there Anaximander's own

¹⁹ *REG*, 70 (1957), 47-55.

²⁰ Two years after his first article Wiśniewski proposed that traces of the Pythagorean notion that things are numbers are possibly to be found in Anaximander's geometrical conception of the earth as cylindrical in shape, similar to the drum of a stone column; that the Pythagorean two-fold principles of *apeiron-peras* are possibly hinted at in his theory of contraries (hot-cold), although he explicitly mentions only *apeiron*. See "*Apeiron* d'Anaximandre et de Pythagore," *SIFC*, 31 (1959), 175-78. On Anaximander's geometrical theories in relation to the Pythagoreans, also see C. H. Kahn, pp. 96-98; N. Rescher, "Cosmic Evolution in Anaximander," *Studium Generale*, 11 (1958), 726-28; D. O'Brien, "Anaximander's Measurements," *CQ*, n.s. 17 (1967), 423-32; J.-P. Vernant, "Géométrie et astronomie sphérique dans la première cosmologie grecque," *Pensée*, 109 (1963), 82-92.

²¹ "Anaximander and Arguments Concerning the *Apeiron* at *Physics* 203b4-15,"

as to content? Yes, as these two considerations indicate. Not Anaxagoras or Empedocles but only Anaximander could correctly say that "the *apeiron* is the *arché* which surrounds and governs all things" and, accordingly, this passage has "always been regarded as one of the chief *testimonia* for Anaximander's thought" (pp. 19-20). Secondly, a closer examination of the passage reveals that "the text forms an organic whole from which no part can be removed without damage to the rest"; but the doctrine in Argument B (lines b7-15) that "the *apeiron* is imperishable" is expressly there attributed to Anaximander; therefore, the doctrine in Argument A (lines b4-7) must also be Anaximander's (pp. 21-22). Argument B has striking parallels both in Melissus (Diels, 30 A10) and in Plato, *Phaedrus* (245D), and in all three the basic premise is the same: what is generated has an *arché* and *peras* or *telos*. How account for the resemblance between the three? "The most natural explanation is that all three authors are adapting an older argument whose original form has been lost, but which is most faithfully preserved in the version of Aristotle" (pp. 22-24). The conclusion which Kahn draws from his "closer examination" is that in *Physics* 203b4-5 "we have a second virtual citation from Anaximander's book, comparable in importance to the famous sentence preserved by Simplicius" (p. 24).

An indirect confirmation of Anaximander's authorship of the argument as found in Aristotle is the new light which it throws when so dated on such other early fragments as Parmenides, B 8, 6-10; Heraclitus B 103 (also B30 and B60); and Alcmaeon (24 A12; pp. 24-27). Mention of

in *Festschrift Ernst Kapp*, (Hamburg: M. von Schröder, 1958), pp. 19-29. Kahn states (p. 20, n. 3) that the idea for his article was suggested by W. Jaeger, *TEGP*. The passage in the *Physics* which Kahn is studying is quoted above as text III.

Also in 1958 there appeared an article by Marcel de Corte, "Mythe et philosophie chez Anaximandre," *LThPh*, 14 (1958), 9-29, which refers often to R. B. Onians' book on the origins of European thought (see Bibliography below). Anaximander's position weaves together many strands of thought: poetry, myth, metaphysics, physics (see pp. 14, 26 and *passim*). With Zeller and *contra* Burnet De Corte thinks that for the Milesian there is an infinity of successive worlds, which *to apeiron* contains virtually: "En fait, ces *kosmoi apeiroi* sont simplement les mondes 'non liés,' 'non encerclés' que l'*apeiron*, contient à l'état virtuel. Chaque fois qu'un monde naît, il est affligé d'une limite circulaire (*peras*), mais, à sa mort, il retourne, comme tous les êtres, à l'*apeiron*, dont il est issu, et reprend sa caractéristique originelle d'*apeiron*, de monde dépourvu de limite circulaire" (p. 22). The relation of the *apeiron* to *peras* is, then, "le rapport . . . du non-lié au lié, du non-encerclé à l'encerclé, comme relation d'un univers sacré à son principe divin. De fait, l'*apeiron* est divin selon Anaximandre" (*ibid.*). That relation is also one of form to matter: "L'*apeiron* qui enveloppe le monde joue le rôle de forme, et le monde qui est enveloppé par lui joue le rôle de matière: celle-ci participe à celle-là et en reçoit le caractère sacré" (p. 23).

Alcmaeon prompts Kahn to remark that the "idea of incessant recurrence in the eternal life of nature, as opposed to the clearly defined *arché* and *peras* of perishable things, must be at the root of the Milesian 'eternal motion,' and of the early concept of 'eternity' in general." Kahn then comments about the ancestry of the philosophy of Anaximander and other Milesians. "The Ionian study of Nature would in fact be inconceivable without that detailed knowledge of celestial recurrences which had been accumulated by the Babylonian astronomers before them... Philosophy arose from the systematic study of heavens [as Plato states in *Timaeus*, 47A]. The Greek notion of time, at any rate, was always associated with the great astral periods." Furthermore, the roots of the "philosophic idea of eternity... are sunk deep in the astral notion of time. Its first fruit, moreover, is a new conception of divinity defined by contrast to the Homeric gods. The traditional deities are free from death but not from birth; the god of the philosophers has no share in either" (p. 27-28). Besides the "native genius of the Ionian philosophers and their borrowed astronomical knowledge, we can discern a third factor contributing to the birth of this conception [of eternity]. The clarity and the rigor of Anaximander's ideas must reflect the early development of Greek geometry" (p. 29).

Two years after his article Kahn published a significant book, *Anaximander and the Origins of Greek Cosmology*,²² which aims at counter-acting the tendency of ancient and modern historians of philosophy to "treat these early [Presocratic] philosophers as so many exalted individualists, whose relationship to one another must be largely a matter of polemic." Kahn intends rather "to throw light on the essential unity of early Greek natural speculation, ... to emphasize those fundamental ideas which bind the early thinkers to one another. It is these common traits which permit us to recognize the Greek philosophy of nature as a unity and as a whole." This is "the world-scheme which Parmenides presupposes, and against which he is in part reacting ... [and which is] the cosmology of Anaximander" (p. 5-6). Kahn carries out his intention by a careful critical analysis of Theophrastus' report on Anaximander so as to test the reliability of Theophrastus' information (pp. 11-71); by a historical discussion of such concrete factors in Anaximander's doctrine as the formation of the heavens, the causes of meteorological events, and the

²² New York: Columbia University Press, 1960. Also see C. H. Kahn, "Anaximander," *EP*, 1, 117-18. For a strong criticism of Kahn's book, see D. R. Dicks, "Solstices, Equinoxes, and the Presocratics," *JHS*, 86 (1966), 26-40; for Kahn's reply see *ibid.*, "On Early Greek Astronomy," 90 (1970), 99-116.

origin of life on earth, as well as of the more general philosophy of nature within which those theories have their place (pp. 75-165); and, finally, by a detailed interpretation of Anaximander's only fragment (pp. 166-96). The book terminates in a series of important conclusions (pp. 199 sq.). "Anaximander's conception of the world is . . . the prototype of the Greek view of nature as a cosmos, a harmonious realm within which the waxing and waning of the elemental powers march in step with the astronomical cycles." Moreover, "what Anaximander and his . . . [fellow Milesians] brought into being is nothing less than the science and the natural philosophy of antiquity" (p. 199). *Physis* is the "catchword for the new philosophy." It meant not only the essential character of a thing but (and especially) the process of natural origin and development, a meaning it would keep through the Presocratics and Plato until Aristotle, who abandoned this last named meaning because his universe is eternal, un-generated and without origin (pp. 200-204). But "from the sixth to the fourth century . . . the Greek study of nature is a close-knit unity, and the originality of the original thinkers is intelligible only against the background of a continuous tradition . . . of a common set of problems, principles, and solutions . . . The constant goal of this common intellectual enterprise is to explain how the world and all that it contains have reached their present form" (pp. 207, 209-210). And the common basis which clearly underlies all these conceptions of *cosmos* and *diacosmos* as "all-embracing arrangement of parts" is the "Milesian view of the natural world as an organized system, characterized by symmetry of parts, periodicity of events, and equilibrium between conflicting factors" (p. 230).

In the course of his book Kahn frequently disagrees with other scholars. Against McDiarmid he considers it a "mistake to suppose that Theophrastus was ever stupidly bound by the obiter dicta of his master . . . [His own extant metaphysical work] bears witness at least to the independence of his critical judgment." Indeed, "the real historical value of Theophrastus' account appears wherever he diverges from, or goes beyond, the statements of Aristotle." The original writings of the Presocratics "were carefully studied by Theophrastus, and faithfully represented in the expository sections of his work" (pp. 20-21). Against McDiarmid, Kirk and others: the doxographers are to be interpreted as meaning that Anaximander was the first to introduce "this very term of *arché*" and not "this name *apeiron* for the *arché*" (pp. 30-32). Against Hölscher: Simplicius did not import into Theophrastus the Aristotelian notion of "opposites." Rather, most likely Anaximander's cosmogony itself involved a separating out of two opposing and primitive principles, the hot and the cold (pp.

40-42).²³ But the fact that "opposing principles or powers arise out of the *apeiron* by separating-off (*from one another*, as well as from the Boundless itself) does not prove that they were already pre-existent in the *apeiron*, or that Anaximander thought of the latter as a kind of mixture or blending of opposites" (p. 41). Against Zeller and others: in his texts on "an intermediate material principle," Aristotle refers to Anaximander (pp. 44-46). *Contra* Burnet and others but with Zeller and Cornford: it is unlikely that Anaximander held there to be infinite worlds (pp. 46-53), although perhaps he does speak of a plurality of *ouranoi* and of *cosmoi* – the former possibly referring to the "various celestial rings which compose his structure for the visible heavens," the latter perhaps referring to "some lower 'arrangements' of atmosphere or earth" (p. 50). Against Ritter, Nietzsche, Diels and others: in the Fragment of Anaximander "making amends and giving reparation" does not pertain to the Boundless but points "to a relation of the elements among themselves" (where "elements" are "the opposite powers of cold and heat, moisture and dryness, darkness and light, and also the main portions of the visible world, regarded as embodiments of these universal factors"; pp. 167, 178).²⁴ More precisely, how is this mutual reparation for wrongdoing to be understood? First of all, both clauses of the Fragment (see above, text I) concern one and the same things: the "elements" (pp. 178-83).²⁵ The first states the necessary return of mortal elements back into the opposite powers from which they are generated; the second explains this necessity as a just compensation for the damage done at birth. The elements feed one another by their own destruction, since what is life to one is death for its reciprocal (p. 183; see also pp. 195-96).

Finally, Kahn furnishes an impressive interpretation of what the Greek author intended by *to apeiron*. It is primarily "a huge, inexhaustible mass, stretching away endlessly in every direction . . . a universal body or mass surrounding the world." It is "the great cosmic mass encircling the spherical body of our star-studded heaven" (pp. 233-34). We have no information that the *apeiron* itself is spherical in shape or capable of rotary motion

²³ See also, Ch. II, pp. 119-65, especially 163: "We cannot pretend to say just how many primary powers or portions were generated by Anaximander out of the *apeiron*. Not only hot and cold, but the other major pairs of opposites must also have figured among them, incorporated in (or acting upon) the visible bodies of the natural world. Etc." See G. E. R. Lloyd, "The Hot and the Cold, the Dry and the Wet in Greek Philosophy," *JHS*, 84 (1964), esp. 95-100.

²⁴ For a survey of interpretations of the Fragment, see pp. 193-96. For a discussion of Kahn's own view, see J. Kerschensteiner, pp. 59-66.

²⁵ For Kahn both clauses of the Fragment are Anaximander's. See pp. 172-78.

(against Heidel and Cornford). We know solely that it "surrounds the world at present, and originally served as the *arché* or starting point in its formation" – *arché* both in the spatial sense of a foundation upon which all else rests and in the temporal sense as the first and eldest of things, from which all others arise in the course of time. More exactly, for Anaximander the *apeiron* "secretes" the seed out of which emerge the opposing principles whose interaction constitutes the world. These principles need not be supposed (as many modern interpreters do) to have been present in their source before generation "so that the *apeiron* was therefore a kind of mixture." Nor need they be thought of as potentially present in their source. For our Milesian philosopher "they were no more pre-existent in the *apeiron* than children pre-exist in the body of their parents before conception" (pp. 235-36).

He accepted as an unquestioned fact that one thing could arise out of another, as day arises out of night and spring out of winter, and he expressed this fact in the most significant way he or any man of his time could imagine, by analogy with the generation of living things. He concluded that, since the constituent principles of the world as we know it are in a continuous and reciprocal process of transformation, they must themselves have arisen out of some more permanent source that is partially or wholly unknown to us, but which must be such as to offer an inexhaustible store of creative power and material. He called this unknown world source *to apeiron*, "that which is inexhaustible," and he identified it with the equally mysterious outlying body which holds the visible world in its embrace. The Boundless represents the unknown entity which encompasses the known world in time as well as in space. It is *apeiron* and *periechon* in both respects, by contrast with the limited and perishable structure of the heavens (p. 237).

Finally, *to apeiron* is divine; it is "by definition 'non-traversable' or 'inexhaustible'; it is neither air nor water nor anything of the sort; unlike these things, it does not change into something other than itself; its motion or life-activity lasts forever; its existence is affected neither by old age nor by death; it is in short immortal, uncorruptible, and divine." It cannot be reduced to merely "material or to quantitative terms. It is not only the matter but the motor of the world, the living, divine force of natural change." It is "not only imperishable but ungenerated, without any starting point or origin (*arché*) in the past. In contrast to the ageless but generated gods of the epic, the philosophers of the late sixth and early fifth centuries all proclaim a new conception of divinity, which is free from birth as well as from death." It guides and governs all things: "in addition to being the vital source out of which the substance of the world has come and the

outer limit which encloses and defines the body of the cosmos, the *apeiron* is also the everlasting, god-like power which governs the rhythmic life cycle of this world. Thus it is not only the idea of the well regulated cosmos which Greece owes to Anaximander, but also that of its regulator, the Cosmic God" (pp. 237-38).

Guazzoni Foà, Solmsen, Classen

Also in 1960 Virginia Guazzoni Foà published an article seeking to unravel the meaning of infinity in Anaximander and other Presocratics.²⁶ Some scholars (she says) stress the quantitative aspect in *apeiron* by interpreting it as signifying what is without spatial or temporal limits. Others, though, see in it a qualitative notion by considering it to mean qualitative indetermination (e.g., Natorp, Otto, Brochard, Tannery, Rey, Chevalier) in such a way that infinity is opposed to perfection (pp. 466-68). But still others (Mondolfo, Mazzantini, Ballauff, Bignone) find infinity in Anaximander and other early Greek authors to be aligned with perfection and ontological fullness. Guazzoni Foà, who places herself in this last group, detects this alignment in a text from Antiphon the Sophist (Diels 87 B10), in Anaximander's own Fragment, in Melissus (Fr. 2 and 5), in a statement Plutarch makes concerning Anaximenes, in Anaxagoras' description of *Nous*, in Parmenides' Fragment 8 (pp. 468-69, 470-71). This last our Italian scholar analyzes with care. The last word of line 4 of this Fragment she reads as ἀτέλειστον, translates as "infinito" and also gives as a possible meaning "non ulteriormente perfezionabile." Parmenides used this Greek word because it joins within itself infinity and perfection (pp. 471-73).

To sum up: Anaximander, Melissus, Anaxagoras and Parmenides all agree in linking infinity with perfection. Despite this agreement, there are differences. Anaximander and Anaxagoras conceive of perfection dynamically: movement pertains to the *arché* of each (which is, however, an immanent principle for Anaximander but a transcendent *Nous* for Anaxagoras). Parmenides and Melissus think of perfection statically: movement for each is absent from true reality, each holds "un'infinità di permanenza" (pp. 473-74).

In 1962 Friedrich Solmsen began an article on Anaximander by asking whether Aristotle's *Physics*, 203b10 ff. (see above, text III) consists of

²⁶ "Dall'*Apeiron* di Anassimandro all'*Ateleston* di Parmenide," *GM*, 15 (1960), 465-74. For a reaction, see C. Carena, "A proposito dell'*Apeiron* di Anassimandro," *Rivista Rosminiana di Filosofia*, 55 (1961), 39-40.

excerpts from Anaximander's treatise or is a cento culled from works of different physicists.²⁷ In replying Solmsen joins two cola from this passage (καὶ περιέχειν ἅπαντα καὶ πάντα κυβερνᾶν) to another from *ibid.*, 207a20: καὶ τὸ πᾶν ἐν ἑαυτῷ ἔχειν. He then reconstructs a sentence of which *apeiron* would be grammatical subject. (ἅ)παντα ἐν ἑαυτῷ ἔχειν καὶ (ἅ)παντα περιέχει καὶ (ἅ)παντα κυβερνᾶν (pp. 110-112). The expressions ἐν ἑαυτῷ ἔχειν and περιέχειν do not express the same idea. Both mean "include in oneself" but the latter adds the notion of control, precedence, superiority (pp. 112-13). These philological reflections lead Solmsen to conclude that "the reconstructed sentence is . . . probably . . . a perfect description of the *apeiron* as it was conceived by Anaximander" (p. 112). Nor is *Physics*, 203b10 ff. a cento of thoughts and quotations taken from different earlier thinkers. Rather.

Anaximander is the only philosopher whom he mentions by name and there are good reasons to doubt that any other Presocratic would speak in such solemn words about the *apeiron*. As far as we can form an opinion on the basis of the fragmentary material, Anaximander is the only thinker for whom the *apeiron* itself was the enduring and all-encompassing entity, the power in control of all that comes to pass in the Universe (p. 114).

Solmsen next (pp. 115-19) samples the later history of physical thought (Empedocles, Anaxagoras, Stoics, Plato's *Timaeus*, Aristotle's *De Caelo* and *Meteorologica*) and discovers that these subsequent thinkers support his contention "that there is considerable difference between ἐν ἑαυτῷ ἔχειν and περιέχειν": the latter is a concept less distinctly or exclusively physical in connotation (p. 116). Another discovery is that Anaximander's Infinite has ceded its titles to the Cosmos itself, as in Aristotle, according to whom "the three venerable capacities originally associated with the *apeiron* become completely absorbed into the physical organization of the Cosmos" (pp. 115-16, 118-19). After his survey of *apeiron* in later Presocratic thought, he wonders whether Aristotle does not elsewhere in Book III of the *Physics* look to Anaximander for descriptions of the *apeiron*. What of the infinite as "that outside of which there is nothing" (206b33 ff.)? Yes, reasonably so (pp. 120-22). What of "infinite" as "intraversable" (204a2ff.)? Yes, and possibly illuminating Anaximander's debt to Hesiod's *Theogony* (p. 122). What of the Infinite as containing eternal motion? Yes, doxographers "actually ascribe an eternal motion to Anaximander's *apeiron*. I should accept their statements as substantially correct, at least in the sense that the contents of the *apeiron* are in constant motion – this is not the same as to believe that the

²⁷ "Anaximander's Infinite," *AGPh*, 44 (1962), 109-131.

apeiron itself, and as a whole, performs a movement, like locomotion or rotation” (pp. 124-28, especially p. 126). Does Anaximander characterize the time and duration of his Infinite as infinite? Such a characteristic would not be at all foreign to his thought, and he might possibly say ἄπειρος αἰὼν or ἄταυστος αἰὼν (pp. 129-31).

Still another article on Anaximander was put out in 1962 – this one in German by C. Joachim Classen and entitled simply, “Anaximander.”²⁸ In it the German scholar sought to compare Anaximander’s manner of expression with that of the poets and of Hesiod and, secondly, to sketch Anaximander’s own philosophical and scientific position (p. 159). He first calls attention to Theophrastus’ statement (in Anaximander’s Fragment preserved by Simplicius) that Anaximander “spoke of them [elements as making amends and giving reparation for their offense] thus in rather poetical terms”; to the poetic similes Anaximander supposedly used in describing the earth, sun and other heavenly bodies (e.g. DK12A11: “the earth is round like the drum of a stone column”); and to ἀθάνατος καὶ ἀγήρω, which epic poets applied to the gods (pp. 159-61). He then moves on to juxtapose Anaximander with Hesiod’s *Theogony*, 736 ff., which presents a vision of the huge chasm which holds the “springs” and the “boundaries” of heaven, earth, sea and Tartarus and which one can traverse only with difficulty. That notion of an intraversable chasm is, Joachim Classen affirms, the direct inspiration for Anaximander’s *apeiron* (pp. 161-62).²⁹

How does Anaximander conceive to *apeiron*? It is not an abstraction, not something general, but something entirely concrete, whose end no one can reach and which no one can succeed in passing through. It involves a definition or conception which arises from experience but results from mental construction.

Denn to *apeiron* soll nicht etwas Allgemeines bezeichnen... sondern ganz konkret das Eine, dessen Ende man nicht erreichen, das man nicht durchdringen

²⁸ *Hermes*, 90 (1962), 159-72. Also: “Anaximandros,” *RE*, 12 (1970), 30-69.

²⁹ For a similar affirmation also see F. Solmsen, *art. cit.* [see *supra*, note 27], p. 123; F. Solmsen, “Chaos and *Apeiron*,” *SIFC*, 24 (1949-1950), 235-48, especially p. 245; G. Vlastos, *art. cit.* [see *supra*, note 5], p. 161, n. 3; M. C. Stokes and P. J. Bicknell, whose articles are analyzed below. For U. Hölscher, though, the inspiration for Anaximander’s *apeiron* is not Hesiod’s Chaos so much as the oriental notion of “endless depths”; see *art. cit.* [see above, n. 16], p. 417. For Jacques Pirenne Anaximander acquired his notion of the Infinite from *chaos primordial égyptien: un corps illimité dont émergea un jour la terre*; see “L’influence égyptienne sur la philosophie ionienne”, *AIPhO*, 15 (1958-1960), 76-78, esp. 77; for W. Burkert’s view see below, n. 276; also see the following names in Bibliography below: Conti, Esnoul, Pró, Renou. Somigliana.

kann, eine Bestimmung, die von der Erfahrung ausgeht, in ihrer Zusammenfassung und Verallgemeinerung aber Resultat gedanklicher Konstruktion ist (p. 162).

It is not indeterminate (*aoriston*), nor does Aristotle, in speaking of *apeiron* as "an intermediate substance," have Anaximander's principle in mind (p. 164). Obviously, it is a spatial conception, and this Classen takes some pains to stress (pp. 163, 166). It is also a principle – in fact, Anaximander was the first to have called the *apeiron* an *arché* (p. 166). He describes it not statically as a "groundwork" or "foundation" but dynamically as a "primordial source," from which all else emerges under the impetus of eternal motion (pp. 166-67). It is *to gonimon* – a process which generates the hot and cold not in any mechanical fashion but

im Bilde organischen Wachstums in Analogie zum Geschehen in der Natur. *To gonimon* ist die Kraft des Apeiron, die den Kosmos aus dem Apeiron wachsen lässt: das was der Dichter Eros nennt (p. 168).

One should not think, though, of the *apeiron* as surrounding, steering or controlling all things; these verbs should not be applied to Anaximander's first principle (p. 168).

Finally, although Anaximander used some poetical and figurative expressions, he is no poet. He is a cosmologist writing in prose, who has predilection for factual, sober, literal statements and whose cosmological doctrines are marked by a genuine mathematical character (pp. 170-71). He is, in fact, a natural scientist, an astronomer and, above all, a geographer who drew a map of the world (p. 172).

Paul Seligman

In an important book, also published in 1962, Paul Seligman touched upon most of the controversial points raised in previous literature on Anaximander.³⁰ *Contra* Cherniss and McDiarmid: since there are important details of doctrine on which Aristotle and Theophrastus clearly differ, "this suggests that Theophrastus preserved an independent judgment which, given the purpose of this work, should receive prior consideration There is no reason to reject any doctrine merely because Theophrastus phrased it in Aristotelean terms" (p. 15). *Contra* Burnet and others: Anaximander was the first to use the term *arché*, thereby signifying

³⁰ *The Apeiron of Anaximander: A Study in the Origin and Function of Metaphysical Ideas* (London: University of London Athlone Press, 1962).

"beginning and origin" (pp. 26-28). Although Aristotle's *apeiron* conceived as a sensible body infinite in extent is not Anaximander's, although the latter's *apeiron* is not the infinite of mathematics, still it possibly is "spatially infinite" in the weaker, poetical sense that it is so vast that its boundaries can never be reached or, for that matter, never be known. It is hardly plausible (*contra* Cornford) that Anaximander thought of his *apeiron* as a sphere or circle (pp. 32-35). *Contra* Kahn and others: although Anaximander may have thought of *to apeiron* as something "besides the elements" (*to para ta stoicheia*), Aristotle's description of it as "what is intermediate between" two elements is not applicable (pp. 35-39). Although "opposites" do figure in Anaximander's cosmogony (*vs.* Hölscher; pp. 62-65), still they are not present in the *apeiron*, which (*vs.* Cherniss) is not a mechanical mixture of particles (pp. 42-46) nor (*vs.* Vlastos and Cornford) a chemical fusion (pp. 46-49). Because the *apeiron* is essentially alive, it is not a mere body; but it is not spiritual or mental, either. It is both like and unlike nature: like in being alive and productive, unlike in being without limits, everlasting and inexhaustible. Its eternal motion is not physical but a manifestation of life, not mechanical but vital (pp. 53-56). His philosophy is both monistic and dualistic: "monistic because there is one single originating 'principle,' but dualistic in as far as there is a decisive distinction between 'principle' and nature, between the everlasting *apeiron* and the things that come-to-be and must pass away" (pp. 54-55). It is plausible that Anaximander may actually have described his *apeiron* as *to theion*. Yet his system is not a theology (*vs.* Jaeger, Burch and others): his *arché*, though considered as of highest value, is not set up as an object of worship or bound up with a definite creed. His is a cosmological system, where *to apeiron* is "only relevant to the ever-recurring events of generation and destruction . . . Things are not related to it as individuals but in their utmost generality *qua* existing and temporal" (pp. 57-60).

Not only is the second clause of the so-called Fragment of Anaximander directly from Anaximander himself but (*contra* Burnet, Heidel, McDiarmid, Kirk) so too is the first clause (pp. 66-71). What is being expressed is "a perfectly clear line of thought: from generation to destruction, to the reason why of destruction" (p. 71). The *arché* is not itself a party to "paying retribution . . . for wrongdoing," which holds only between things and things. These do not "commit *adikia* against the *arché* in the mystical sense that their coming-to-be, i.e., their separation from the *arché*, is the crime for which they have to atone by their death" (*vs.* Diels). In summary, the import of the *adikia* doctrine is that things must pass away, because they have to make amends to one another for their wrongdoing. The notion

of justice here invoked is a retributive one, according to which the guilty party suffers punishment and makes reparation to the injured one corresponding to the damage which it has itself inflicted. The second clause should not be restricted to just minor cosmic and seasonal changes (vs. Kirk). Nor is it merely Anaximander's attempt to justify his choice of *apeiron* as *arché* against Thales and others (vs. *McDiarmid*). The two clauses neither are identical in meaning nor refer solely to the opposites (vs. Kahn; pp. 71-80). Practically all doxographers attribute a doctrine of innumerable worlds to Anaximander and rightly so (vs. Kirk and others), for Anaximander believed in an infinite succession of single worlds (vs. Burnet and Cornford). This doctrine is "the ultimate consequence of the universal law which dominates everything that comes-to-be. Worlds are innumerable because each world dies, and the *apeiron* which gave birth to it, possesses the *aidios kinesis* and thus gives rise to new worlds" (p. 128; see pp. 125-29).

In view of such a list of differences with other scholars, one might be tempted to think that Seligman's treatise is mainly a polemic. Not so. His aim is quite different and he makes decisions on controversial topics only as a means to reaching his goal, which is twofold: to elucidate Anaximander's conception of *to apeiron* and, secondly, to contribute towards the understanding of speculative philosophy in general (p. 1). This second aim is explained in some detail and is operative throughout the book. It is to be achieved by investigating a metaphysics from the point of view of its key-ideas, which are "ultimate principles of reality, in the light of which man's understanding of the world and of himself could be directed into new channels and re-appraised" (pp. 1-2). One's approach must be historical and phenomenological, although this latter adjective is not taken in Hegel's or Husserl's sense (p. 6; also see p. 61).

The extent to which Seligman achieved this goal of understanding metaphysics in general can be ascertained by reading his final two chapters ("On the Function of Metaphysical Ideas in General" and "On the Value of Speculative Philosophy"), which are entirely given over to summarizing the insights gained from his study of Anaximander. Instead of analyzing those two chapters, though, let us turn to prior chapters, in which Seligman sought to elucidate what Anaximander himself meant by infinity. At times these are complicated (unnecessarily so, I would say) because of Seligman's approach through such complex categories as "cosmic vs. personal *adikia*," "object- vs. subject-reference of a doctrine," "pre-metaphysical situation vs. metaphysical solution and transformation," "formal vs. material function," the first of which has two subfunctions and the second has four, and

so on. Despite those complexities, the following paragraphs appear to be an accurate report of Seligman's account.

1) The world and its contents (heavenly bodies, the earth, men and other terrestrial things) arose from *to apeiron*, i.e., that which has no limits; that which is so huge that its boundaries cannot be reached or known; that which is itself without origin or termination, although the origin and term of all else; that which is everlasting and imperishable; that which is divine; that which is neither matter nor spirit but transcends both; that which is essentially alive because of its eternal motion; that which is distinct from all its products (pp. 16-17 and *passim*).

2) How, more precisely, is the origin of the world to be understood? It comes into being in consequence of the everlasting motion which belongs to the *apeiron*. A generating power (*gonimon*) is separated off from the Infinite and produces the cosmic opposites of hot and cold. "These form themselves into the great regions which make up our world [for details, see pp. 17-18] and it is from them all living creatures arise" (p. 73). The vital processes of the sublunary world consist of a rendering of justice for mutual wrongdoing or *adikia* (p. 16).

3) In order to plumb Anaximander's position more deeply, one must juxtapose it with Hesiod's *Theogony*, which expresses the premetaphysical situation of the struggle of opposites in concrete, nonphilosophical language. By an act of spontaneous generation Earth (Gaia) begot Heaven (Ouranos). These then gave birth to the Titans (among others). Kronos and Rhea (two of the Titans) gave birth to Zeus. Conflict broke out on many fronts: between Earth and Heaven, between Kronos and Heaven, between Zeus and Kronos (pp. 88-89; 99-101).

4) The parent-offspring relationship of the gods which Hesiod pictures for us anticipates features of Anaximander's *adikia* doctrine. Injustice is inescapable: the younger generation cannot come into fulness of life and power unless it removes the older one. Secondly, paying the penalty in the case of one is automatically matched by injustice in the other: the offspring becomes guilty as he inflicts deserved punishment upon his fathers (pp. 102-104). Accordingly, Anaximander's theory of cosmic *adikia* was rooted in the primordial conflicts depicted in the *Theogony* and the problem which actuated his thought was a "disorder in the 'basic pattern,' by no means accidental but inherent in the very processes of life. What Hesiod had encountered in the deeds of the gods as they emerged from their initial concrescence with nature, Anaximander reformulated at a generalized and more abstract level, linking *adikia* and retribution with the coming-to-be and passing-away of... all that exists qua existent, what-

ever its individual character or fortune" (p. 107). To summarize:

Anaximander's law of existence is the law of *all succession*, and there is thus no distinction between the basic cosmic powers and the generations of individuals. No matter whether it is a question of day and night, summer and winter or heaven and earth, whether of male and female or father and son – encroachment and reparation are of the same nature. Each member of a pair of opposites comes to its prime through injustice and perishes through injustice (p. 110).

5) But how does Anaximander's Infinite fit into this picture in which "at one stroke he exposed existence as an ever-recurring struggle of guilt and retribution" (p. 111)? It relieves and transforms the situation. The Infinite is distinct from and other than all things. They are limited by their spatio-temporal existence; the *apeiron* is timeless and outside the world. Their coming- and ceasing-to-be are intrinsically bound up with wrongdoing and atonement; the Infinite transcends that law and mode of existence (pp. 112-14). As the source of all things and itself without a source, the Infinite possesses all productive power, which it only loans to things. Their passing-away into the Infinite is a redemption and a release from injustice and atonement. The Infinite governs all things and encompasses them (pp. 114-25).

6) By surveying Hesiod's book, one accordingly realizes that Anaximander's conception of the *apeiron* represents "a new answer to a fundamental problem which he met at a level of greater generality." Now a final question: Are there any ancestral notions of the *apeiron* itself, "pre-philosophical antecedents which may be regarded as the matrices in which it came to life" (p. 130)? Yes, Okeanos in Greek mythology. The son of Earth and Heaven, he is the borderstream which surrounds the earth and from which all other rivers issue; he is the horizon, the boundary and meeting-place of both Earth and Heaven; he encircles the world, encompassing and embracing all; he is in continuous motion. In short, Okeanos is a "*preconceptual symbol*, i.e., a notion pregnant with a meaning which only later ages could make explicit" (p. 138) and which would then appear on a philosophical plane as Anaximander's Infinite (see pp. 134-45).³¹

Guthrie, Gottschalk

Also in 1962 W. K. C. Guthrie began publishing a "comprehensive history of ancient Greek philosophy in English, on a considerable scale,"³²

³¹ On Okeanos see U. Hölscher, *art. cit.*, pp. 401-410.

³² *A History of Greek Philosophy*, Vol. One: *The Earlier Presocratics and the*

the first volume of which contains an informative and sane discussion of Anaximander (pp. 72-115). It begins with a word of caution and then turns to the Greek texts. Anaximander's single book (which he himself would almost certainly have left unnamed but which later came to be called "On Nature") can be safely assumed to have been read by both Aristotle and Theophrastus; hence, we must be "cautious in criticizing what they say from the standpoint of our own comparative ignorance (p. 76).³³ In the so-called Fragment of Anaximander the second clause certainly preserves some of his actual words and the first clause is a true representative of his thought (with Diels, Cornford and *contra* Burnet and others). Anaximander was the first to give the name *apeiron* to the *arché*. In elaborating his physical theory, he took a momentous step and arrived at the notion of the nonperceptible.

Anaximander then rejected the idea that water, or any of the popularly (and later philosophically) recognized elemental masses visible in the world of today, could have served as a basis for all the rest. Instead he posited an unnamed substance behind them all, less definite in character, which he described as *apeiron* (p. 78).

Involved in the notion of the Boundless was the notion of the primary opposites (vs. Hölscher): the hot, the cold, the wet and the dry. These are not qualities but things (with Cornford). Hence, it was possible to think of the hot and cold as two opposed things which might be fused together in an indistinct condition, like a mixture of wine and water (p. 79). The second clause of Anaximander's Fragment refers to these opposites.

There is a sense in which water (the cold and wet) can and does give birth to its opposite, fire (the hot and dry) It was in fact a common Greek belief, which emerges still more clearly in Anaximenes, that the fiery heat at the circumference of the universe . . . not only vaporized the moisture of earth and sea, thus turning it into mist or air, but finally ignited it and transformed it into fire . . .

In this sense fire *can* be created out of water, but only because of the simultaneous existence of both, and, as Anaximander says, their balance is always being redressed: the encroachment of one opposite is followed by a retribution in which the other regains the lost ground. Fire becomes cooled into cloud, cloud into rain, which once more replenishes the moisture on earth (p. 80).

More in detail, what is signified by *apeiron*, the name which the Greek philosopher gave to the single material substance from which the world-

Pythagoreans (Cambridge: University Press, 1962), p. ix.

³³ For his criticism of Cherniss' and, especially, McDiarmid's excessively low evaluation of Aristotle and Theophrastus as historians of philosophy, see W. K. C. Guthrie, "Aristotle as a Historian of Philosophy: Some Preliminaries," *JHS*, 77 (1957), 35-41.

order emerged by a “separating-off”? Of the five considerations which Aristotle mentions as leading one to assent to an *apeiron* (*Physics* 203b15), the first (temporal limitlessness) is applicable to Anaximander’s *arché*, which he called “deathless and imperishable” since it is a beginning without a beginning or end (pp. 83-84). Although it is unlikely that Anaximander grasped the notion of strict spatial or quantitative infinity, still he certainly regarded the *apeiron* as an enormous mass surrounding the whole of our world, and it may even have presented itself to his mind as a vast sphere. If spherical, it could also be boundless because one could go on and on around it without interruption (pp. 84-85). It could also be *apeiron* because indeterminate: it has no internal *perata*, no line could be drawn between part and part within the whole. If so, it would be an unlimited body made up to different sorts of matter fused into an indistinguishable mass. Which of those senses of “Boundless” was uppermost in Anaximander’s mind? Likely, the notion of internal indeterminacy rather than of spatial infinity, since the former offered a solution to the problem that he was trying to solve.

A primitive stuff must be, so to speak, a neutral in these hostilities [observed between opposites], and must therefore have no definite characteristics of its own. It must hold, inactive in the first place and suspended as it were in solution, the characteristics of all the future opposites which in due course were to be, in the significant word which was probably his own, “separated off” (or “out”) from it. Here we may find, in all probability, the chief reason why he called his *arche* simply “the *apeiron*.” There were no *perata* in it between the hot, the cold, the wet and the dry. Before the formation of a cosmos, the opposites as such could be said to be as yet non-existent, because they were indistinguishably mingled (pp. 86-87).

The animate self-moving stuff which Anaximander calls *apeiron* both surrounds all things and is also their directive force. As also immortal and imperishable, it is divine.³⁴ If it includes “directive or governing power, it also implies at least some form of consciousness. For Anaximander we have no further evidence on this point, but later monist philosophers ascribe consciousness and intelligence explicitly to their single material *arche*” (p. 88; see pp. 87-89).

The process by which a world-order comes into being is described as a “separating out,” caused by an “eternal motion” in the *apeiron* – a description which one would expect of an *apeiron* which is an initial in-

³⁴ Concerning Anaximander’s asserting that the infinite *ouranoi* are gods also, see p. 112, where Guthrie also explains that the *ouranoi* are “innumerable rings of fire which are the stars, and which resulted from the splitting apart of the original sphere of fire which surrounded the world at its beginning.”

determinate fusion of all the opposites (p. 89). Since this process starts when a "germ (*gonimon*) of hot and cold was separated off from the eternal substance" and since "germ" (an adjective meaning generative, fertile, able to bring to birth) is used of eggs and seed, we may infer that Anaximander conceived "his cosmogony on the analogy of early views concerning the seed of animals and the development of the embryo," although he rejected the anthropomorphic imagery of sexual mating which form the basis of mythical cosmogonies (pp. 90-91). This fertile germ or nucleus, pregnant with the opposites, becomes detached from the Boundless and develops into a sphere of fire enclosing a cold, moist mass, whence (pp. 92-93) come land and sea (that is to say, the earth, which itself needs no support but remains at the center of the universe because of its being equally distant from everything; pp. 98-100) and then the heavenly bodies (pp. 92-98). Just as the world-order had a beginning out of the *apeiron*, so also it will have an end, fading back, as it were, into the formless state from which it came. Only the *apeiron* itself is eternal and ageless, immortal and indestructible (p. 100).

In subsequent pages Guthrie provides a clear and balanced discussion of the origin of animal and human life (pp. 101-104) and of meteorological phenomena (pp. 105-106), events in the present world which must be attributed to the continued operation of the same forces and processes that brought about its formation in the beginning. He concludes by considering at relatively great length (pp. 106-115) the question of whether Anaximander held the worlds to be innumerable. After a survey of relevant evidence in Aristotle, Aëtius, Simplicius and others, he concludes with Zeller and Cornford that "when Anaximander spoke, as he doubtless did (in whatever Greek terms), of an infinite plurality of worlds, he meant a succession of single worlds in time" (p. 111). The picture of reality presented by Anaximander is very different from the Atomists' assertion of the existence of empty and infinite space, distinct from any form of body.

His *apeiron* is not empty space but body, and, more than that, a body which is living and divine. This last fact gives additional support to the supposition that he did not imagine it as strictly infinite in extent Just as the earth is at the centre of the spherical universe, so Anaximander may have vaguely imagined that the universe as a whole arose and had its being and perished within a divine and spherical *apeiron* (p. 114).

H. B. Gottschalk's article, "Anaximander's *Apeiron*," is his reaction to

³⁵ *Phronesis*, 10 (1965), 37-53. At the same time O. N. Guariglia published a

studies on Anaximander between 1950 and 1965.³⁵ Many of these were comments upon apparently inconsistent statements of Aristotle and Theophrastus; consequently, Gottschalk offers his own interpretation of the Greek texts in which these seeming inconsistencies occur. With reference to *Metaphysics* 1069b22: Aristotle does not really claim that Anaximander identified the *apeiron* with his own prime matter (*contra* Cherniss); rather the tentative language in which he states his conclusion shows clearly that he was merely drawing his own inference from Anaximander's writings (incidentally, he and Theophrastus had probably read Anaximander's own book and not merely a collection of excerpts – against Kirk; p. 47). With reference to *Physics* 207a21 ff: Aristotle does not attribute his own doctrine of matter to Anaximander; what he says is that "Anaximander should have arrived at this concept, if he had thought out the implications of his own statements about the first principle" (p. 38). *Re* two passages in which Anaximander is grouped with the Pluralists: According to *Physics* 187a20 Anaximander regarded the *apeiron* as a unity, even though he held that the world came from it by a process involving "separation." *Metaphysics* 1069b22 is a mere aside and is carelessly written; moreover, he is not making "a pluralist of Anaximander, but monists of Empedocles and Anaxagoras" (pp. 38-39). With respect to *Physics* 203b10 ff: although strictly speaking only "immortal and deathless" are ascribed to Anaximander, still "surrounding and guiding all things" are also likely to be his (pp. 39-40). *Re* the nine places in which Aristotle mentions a theory which makes the *arché* something midway between air and water or between fire and air: probably he had Anaximander in mind when he wrote at least some of these passages (pp. 40-41). *Re* Theophrastus' apparent equating of the *apeiron* with the primeval mixture of Anaxagoras because of the word *ekeinos* in line 12: the equation is only apparent (*contra* McDiarmid and others; pp. 41-43).

Before approaching new questions, Gottschalk summarizes the evidence of Aristotle and Theophrastus as follows.

- 1) Anaximander's *arché* was a principle "of the material kind" and he did not assume the existence of a further "moving principle" such as the Mind of Anaxagoras.
- 2) It was called *to apeiron*, in the singular.
- 3) It is "divine," eternal, indestructible, and "governs" the world.
- 4) It is corporeal but not identical with any of the elements or any other known substance.
- 5) The universe was derived from it by a process involving "separation," and in this respect it resembled the primeval mixtures of Empedocles and Anaxagoras.
- 6) Theophrastus classified Anaximander as a monist (p. 43).

long study, "Anaximandro de Mileto. Fragmento B1 DK," *AFC*, 9 (1964-5), 23-155 (see below, Appendix).

The initial new inquiry raised is whether Anaximander's Infinite was a single undifferentiated substance or a mechanical mixture like that of Anaxagoras (as Heidel, Cherniss, McDiarmid hold). The former alternative is correct. Anaximander's doctrine was essentially monistic, in spite of some resemblances to the later pluralists (pp. 43-46). But what of the view that other substances are "separated out" of the *apeiron*? Does not that "separating out" indicate those substances to have existed in it beforehand and, hence, the *apeiron* would be a mixture or, at least, a fusion (Vlastos)? Not necessarily. In the only extant description of Anaximander's cosmogony, based on Theophrastus,

we find that something "capable of producing the hot and the cold" was separated off from the Infinite and out of this a sphere of flame grew round the air surrounding the earth like bark round a tree. From this simile it would appear that Anaximander imagined the formation of the world as an organic process like the growth of a plant or embryo, and the *Apeiron* as something capable of producing seed (pp. 46-47).

If we take the simile at its face value, the pre-existence of things in the *apeiron* becomes very unlikely. What then is the *apeiron*?

Anything infinite, or even anything large enough to surround all things and to be their source, must be completely impartial. It was not enough that it should be different from any of the obvious *dynameis* such as the hot or the cold, light or darkness. It could not have any sensible qualities at all, any more than the atoms of Democritus. It could only be described as the source of all things, everlasting and indescribably vast; these were its only properties. Like the atoms, it was a metaphysical construction, devised to account for the origin of the world. Anaximander's originality lay in his ability to conceive such a thing without clothing it in mythical attributes (pp. 47-48).

Gottschalk warns that modern scholars "who have tried to say more about the nature of the *Apeiron* have inevitably fallen into the same error as Aristotle." Like him they try "to describe the *Apeiron* in terms which make sense to themselves and their audience" (p. 50). This would be true of anyone holding that the *apeiron* was not really a material substance at all (whereas, actually, as the source of all physical things, it must have been itself a body of some kind). Likewise, this would be true of Seligman, who considers Anaximander's thought to be dualistic (an interpretation which might obscure how closely the world was linked with the Boundless in the latter's system; pp. 50-51).

Gottschalk has two last points to make, the first of which concerns the fact that our describing the Infinite can only be indirect.

We cannot describe the *Apeiron* as such. What it meant to Anaximander can

only be gauged by considering its function in his system. This function was a dual one. It was that from which all things have sprung and to which they will ultimately return; and it "embraced and governed" all things. The former role it took over from the first principles of the mythological cosmogonies. These entities only acted as the first parents of the universe. Once it had developed, they had no more part in it. But the *Apeiron* has also usurped the function which the mythographers gave to the later gods who seized power after the creation of the world was complete. This unification was an important feature of the philosophical as against the mythological world-picture and makes it quite impossible to reduce Anaximander's teaching to a re-statement of the old myths, for all that they had some common features. It implies a continuing relationship between the world and its source much more intimate than anything envisaged by Hesiod or writers like him (p. 50).

The second point is that the *apeiron* does not mean "qualitatively indeterminate" as "without internal boundaries or distinctions" (*contra* Tannery, Cornford, Guthrie). Rather, Anaximander used the word in its obvious sense of "spatially infinite," not in an Euclidean sense but unsophisticatedly as "something going on and on without limit... The *Apeiron* surrounds all things; therefore there cannot be anything outside it to limit it, and so it must be infinite." He chose the term "precisely because it did not refer to [any] kind of substance but only to its vastness of extent" (pp.51-53).

F. M. Cleve

In reaction to British and German philologists who have dominated the field of ancient philosophy for the past century, Felix M. Cleve published in 1965 a two-volume book, *The Giants of Pre-Sophistic Greek Philosophy: An Attempt to Reconstruct Their Thoughts*,³⁶ in which he aimed "to recapture for philosophy the field of early Greek thought, that fundamentally important period in which, at the very beginning of philosophic speculation, the basic problems emerge" (p. XVII). This aim he hoped to accomplish by utilizing the extant fragments of the Presocratics so as to reconstruct philosophically not their texts but their doctrines (p. XX).

Before examining his reconstruction of Anaximander's doctrine, it is necessary to sketch Cleve's conception of philosophy, which provides the schema into which he fits the Presocratics. There are three types of purely theoretic philosophy: *theorogon* philosophy, which issues from an artistic bent for building a whole world-picture and produces no system of

³⁶ The Hague: Martinus Nijhoff, 1965. Also see his article, "Understanding the Pre-Socratics: Philological or Philosophical Reconstruction?" *IPQ*, 3 (1963), 445-64, where he honed his slogan, *Philosophia fiat quae philologia fuit!*

cognition but a piece of mental art (pp. XXVII-XXX); *glossogon*, which arises from mere words when speech is substituted for thought and of which Parmenides' doctrine is the prime example among the Presocratics (pp. XXX-XXXII); and *pathogon*, which is rooted in suffering and which produces "a sense-giving faith, a world interpretation, by which the fact of suffering, though unchanged in itself, is shifted into a different light, appears meaningful and, just by that, does no longer hurt so much" (pp. XXXII-XXXV). Those three types form part of the texture of virtually every philosophical system, although one of the three is generally predominant (pp. XXXV-XXXVIII).

Now let us turn to Cleve's philosophical reconstruction of Anaximander's position. This Greek thinker is the sort of philosopher of nature whom Cleve calls a "transformist" – namely, one who holds a changeable and unique element, which in turn is a single primordial stuff that can transform itself into something else (pp. 133-37). Anaximander called his primordial stuff *to apeiron* because it filled infinite space and yet was unspecified as to its qualities (p. 149). But is it a single thing or, rather, "merely a mixture that in the course of the world occurrence dissolves by segregation . . . into various sensible stuffs, the ingredients of that intimate mixture" (p. 149)? Cleve's answer: it is "more than probable that Anaximander's *Apeiron* was meant indeed as something strictly unique" (p. 155). Accordingly, Anaximander is a transformist and, as a result, is no materialist but a panzoist. Also, his "primordial 'principle' surrounding all the worlds is likewise at the same time the body of a god – and of a personal god – whose will is governing all those worlds" (p. 156), which are infinite in number (p. 151) both as simultaneously existing in the infinitely extensive space of *Apeiron* and also as succeeding each other in an endless series (pp. 163-64).³⁷ A personal god? Yes (*contra* Deichgräber): "the god of Anaximander, this divine *Apeiron*, unborn and imperishable, eternal and not aging, is – despite the neuter gender – a consciousness-unit, complete with knowledge and will, a ruler 'whose will is decisive for everything,' which means: a person." What is the relation of the divine *Apeiron* to the infinitely numerous worlds, which Anaximander (according to Aetios) also called gods? They are distinct, a distinction (for the first time in Greece) "between many, in fact innumerable, born and mortal, though long-living gods and the one eternal Lord" (p. 157).

³⁷ One should note, though, that "all these infinitely numerous *kosmoi* are no plurality of worlds, strictly speaking. They are merely a plurality of spatial parts, and a plurality of temporal parts respectively, of the same one world of the naive, ametaphysical monism of all the genuine Hellenes" (p. 164).

If Anaximander's lofty, all-embracing picture of the world has revealed the theogon dimension of his philosophy, the famous Fragment of Anaximander discloses its pathogon side, since according to that sentence every organism within the innumerable worlds "takes birth and lasts for a while and suffers and dies." The question is Why? Why is there death in the world? Because things punish each other "and mutually atone for the crime when the time is due" (p. 159). But what is the crime? It is not the very individuation itself of all individual things as a defection from the *apeiron* (*contra* Nietzsche, Rohde, Diels). Nor is it merely the "opposites" violating their equilibrium (*contra* Burnet) nor the change of seasons (*contra* Heidel; pp. 159-62). Rather, Mondolfo's interpretation alone makes sense: the crime of the worlds consists in their expansion.

Anaximander must have had the vision that those infinitely numerous worlds, invisible to, and equidistant from, each other within the infinite Apeiron, were in an incessant process of expansion, diminishing steadily those distances until finally they would crash into each other and exploding, as it were, would punish each other by this very explosion, as a consequence of which all of them alike would be reabsorbed into the homogeneous, undifferentiated Apeiron from which they had originated (p. 162).

But a question still remains: why is this a crime if the divine *Apeiron* is all-governing? And why, then, is there the endless repetition of the crime in an eternal periodicity? Anaximander offers little explicit reply. Because his philosophy is predominantly theogon, his answer to the pathogon question is, in fact, no answer at all (pp. 162-63).

Stokes, Bicknell

In 1966 P. J. Bicknell of Monash University in Australia published an important article, "*To apeiron, apeiros aēr and to periechon*," *Acta Classica*, 9 (1966), 27-48, which challenged the accuracy of "current accounts of the systems of Anaximander and Anaximenes" that the *arche* of these two continues to surround the world after its formation (p. 27). Bicknell's challenge was inspired by a long paper of Michael C. Stokes, "Hesiodic and Milesian Cosmogonies," *Phronesis*, VII (1962), 1-35 and VIII (1963), 1-34. Hence, let us begin by reporting Stokes' views and then move to Bicknell.

In his paper Stokes intends to explore "the precise relationship between mythical and philosophical cosmogonies . . . [in] a sketch based on the juxtaposition of the cosmogonies concerned in as much detail as is known

and relevant" (VII, 2). The first installment of his article consists of "a long preliminary discussion of the *Tartari descriptio* in the Hesiodic Theogony" (*ibid.*). This lengthy discussion issues into these conclusions at the start of the second installment. The first entity to appear in Hesiod's cosmogony is Chaos (although "what Chaos meant in the time of Hesiod himself is far from certain"; VIII, 3). "Next after Chaos is the coming-to-be of Earth, apparently accompanied by Eros, the principle of generation." Thereafter and in this order come Night and Day (the former is the offspring of Chaos itself, the latter of Night and Erebus), the Heavens with the heavenly bodies (whose parent is the Earth), the Mountains and the Sea, finally the Ocean (the child of Earth and Heaven). With Ocean "the cosmogony proper . . . comes to an end; the birth of Cronus and the Titans belongs more to mythology than to cosmogony" (VIII, 4).

Stokes next charts the cosmogonies of Anaximander and of Anaximenes (VIII, 5-14) and then compares them with Hesiod's. This results in the following Table (VIII, 14):

	<i>Hesiod</i>	<i>Anaximander</i>	<i>Anaximenes</i>
1.	Chaos	Unlimited	Air
1(a)		"the productive" [to <i>gonimon</i>]	
2.	Chaos and Earth	Air surrounding earth	Air above and below earth
3.	Night, Erebus, Day, Aether	sphere of flame	
4.	Heavenly bodies from Earth	Heavenly bodies from sphere of flame	Heavenly bodies from earth
5.	Mountains, Sea, Ocean	Sea and atmospheric air	Sea

Stokes thereupon makes several inferences. Despite differences between the columns in the Table, the last three strata in each column are sufficiently alike to show that Hesiod's cosmogony "had an abiding influence on the Milesian thinkers, and that the order of events" in Anaximander's and Anaximenes' accounts was derived "either from Hesiod or from a source known also to Hesiod." Secondly, Anaximenes preserved one feature of Hesiod's cosmogony (# 4 in the Table: the heavenly bodies arise from Earth) which Anaximander abandoned and, hence, "must have made independent use either of Hesiod or of Hesiod's source" (*ibid.*). Thirdly, although Anaximander and Anaximenes "owed to Thales their apparent depersonalisation of the forces and powers at work or in existence

at the beginning of the world,” still “in other respects their cosmogonies represent a pro-Hesiodic reaction” against Thales (VIII, 15). This latter believed the earth floated on water and presumably “held that the earth arose out of water, which was there in the beginning” – a view which “can be traced with some plausibility to Egyptian doctrines” (VIII, 16). Accordingly, there appears to have been “a break in the tradition of philosophical cosmogony between Thales . . . and Anaximander” (VIII, 16-17).

Considering next the primary substances in each of the cosmogonies, Stokes thinks that these qualities and properties can probably be attributed to Hesiod’s Chaos (VIII, 23):

- (1) Chaos in the developed world and therefore presumably also in the cosmogony surrounds the earth.
- (2) It is therefore a persistent entity within the world.
- (3) Chaos is in internal motion; no beginning of this motion is mentioned.
- (4) Chaos is dark and gloomy.
- (5) Chaos, though not worshipped, is divine.
- (6) Chaos is immensely large.
- (7) Chaos is one single stuff, without mixture.

After careful investigation (see VIII, 23-29), he concludes that Anaximenes’ primal substance (Air) has the same attributes as Hesiod’s Chaos – namely (VIII, 29).

- (1) Location – surrounding the earth.
- (2) Persistence within the developed world.
- (3) Darkness.
- (4) Internal motion.
- (5) Divinity.
- (6) Immense size.
- (7) Probable homogeneity.

Anaximander’s *to apeiron* appears to have the last four of those seven attributes: it was always alive and thus in motion, it is divine, it is indefinitely large, it probably is homogeneous and thus qualitatively indeterminate (VIII, 31-33). But the first three attributes should probably not be associated with it. *To apeiron* “does not surround the earth in close proximity to it, but surrounds the whole universe – and the other universes if there are any.” Secondly, “it is outside our cosmos, and does not persist as an entity within it” because the very term *apeiron* implies that “his primary stuff was not one of the cosmic masses.” Hence, what surrounds the earth it not the Unlimited but *aer*. “So though the Unlimited probably persists after the process of cosmogony is over, it does not do so within

the world" (VIII, 30). Thirdly, it is unlikely "that Anaximander believed his Unlimited to be dark" – otherwise, why did he not call it *aer* (VIII, 31)?

Accordingly, Anaximander is less similar to Hesiod than is Anaximenes. The last two have "made part at least of one of the world masses into the source of them all" – Chasm (associated closely with Chaos and possibly equivalent to mist through its partial identification with Tartarus) for Hesiod, *aēr* for Anaximenes. Chasm-Chaos and Air have in common at least one quality: mistiness (VIII, 33). Although Anaximander has air or mist surrounding the earth, he went beyond Hesiod by positing a primal source which is without any definite qualities and which exists outside the cosmos (VIII, 34; also see *idem*, "On Anaxagoras," *AGPh*, 47 [1965], 245-46).

So ends Stokes' account of Hesiod, Anaximander and Anaximenes. It provoked Bicknell's article, "*To apeiron, apeiros aēr and to periechon*" (see initial paragraph of this section for publishing data), in which he endeavored to support Stokes on one point ("that before cosmogony the Anaximenean *arche* was co-extensive with the present cosmic boundary") but to go beyond him on another ("that the *apeiron* of Anaximander was also coterminous with the fully-fledged world and not a *periechon* in the usually accepted sense"; p. 27). He began by investigating "the original extent of Anaximenes' *arche*" (an investigation which greatly influences his interpretation of Anaximander and, hence, is relevant here). He takes *aer* to be coextensive with the world and not outside it, mainly because of two texts from Aetius. The first of these is Aetius, 2. 14. 3: "Anaximenes held that stars are fixed like nails in the crystalline (or ice-like) substance" (translation from G, vol. I, 135; for the Greek see DK 13 A 14 or Bicknell, p. 29, or KR 154: "Ἀναξίμενης ἦλων δίκην καταπετηγῆναι τὰ ἄστροι τῷ κρυσταλλοειδεῖ). According to this sentence the world of the Milesian philosopher was bounded by the crystalline substance in which the stars were (so to speak) nailed. But what sort of boundary was *to κρυσταλλοειδές*? Most likely, it was not some kind of transparent membrane, as Guthrie would have it, "through which the kosmos inhaled from and exhaled into the circumambient aer" and upon which the stars grew as "a kind of wart or callus" (p. 30). No, it may well have been solid like the "peripheries of the worlds of Parmenides and Empedocles." If so, "it was presumably impervious to infiltration by whatever *aer* there might be outside. If that is so, why postulate it [the circumambient *aer*] at all? It plays no part in the cosmic processes and its only possible function would be to serve as a matrix for further kosmoi," only one of which was

in existence at any one time. Accordingly, Anaximenes seems to have made "his solid firmament the absolute end of everything . . . What Anaximenes may have done is to assimilate quite indiscriminatingly the solid *ouranos* of Homer" (p. 29).

The second text is Aetius, 1. 3. 4, which actually affirms that air encompasses the entire universe but which must be purged of alien notions if one is to catch Anaximenes' own thought: "Anaximenes . . . declared that air is the principle of existing things; for from it everything comes-to-be and into it everything is again dissolved. As our soul, he says, being air holds us together and controls us, so does wind [or breath] and air enclose the whole world" (translation from KR 158; for the Greek see DK 13 B 2 or Bicknell, pp. 31-2: οἷον ἡ ψυχὴ, φησίν, ἡ ἡμετέρα ἀήρ οὖσα συνκρατεῖ ἡμᾶς, καὶ ὅλον τὸν κόσμον πνεῦμα καὶ ἀήρ περιέχει). The microcosmos-macrocosmos parallel implied in the second sentence was a development later than Anaximenes and was superimposed on him by "Aetius or a previous Stoic epitomator." What the Milesian himself intended most likely was simply to compare "the *function* of the soul in a human, and that of *aer* in the cosmos." Just as soul or air controls and holds us together as an active and internal principle, so too cosmic air is interior to the world. "An external *aer* could surely be no more responsible for the dynamism of the universe than something outside it could be responsible for the animation of a human being Anaximenes' non-vaporous, invisible and equable *aer* could only have functioned as the dynamic matrix of the world-bodies from within the world" (p. 32).

But what of Aetius' words, τὸν κόσμον . . . περιέχει? Anaximenes may mean by κόσμος what Anaximander had probably meant: a part and not the whole of the universe. If so, περιέχει (which surely was in Anaximenes' own text) would signify that air surrounds a part of the world and thus is an internal environment. But "post-Theophrastean epitomators . . . read into Anaximenes the Stoic view of *pneuma* surrounding the universe." Consequently, "there is no overwhelmingly compelling evidence for ascribing the notion of a circumambient portion of *aer* to Anaximenes, and for rejecting the historically more probable view that in its original state his *arche* was coextensive with the developed universe" (p. 33).

Bicknell next takes up the same question in Anaximander (in, I must add, a disjointed and difficult section). The text which at first sight most strikingly suggests that his *arche* exceeded and surrounded the world is Aristotle, *Physics*, 203b10 ff. (reproduced above as Text III): "The infinite itself has no principle but is this which is held to be the principle of other things, and to encompass all and to steer all (καὶ περιέχειν

ἅπαντα καὶ πάντα κυβερνᾶν), as those assert who do not recognize, alongside the infinite, other causes, such as Mind or Friendship. Further they identify it with the Divine, for it is 'deathless and imperishable' as Anaximander says, with the majority of the physicists" (translation from R.P. Hardie and R. K. Gaye in *Basic Works of Aristotle*, ed. R. McKeon [New York: Random House, 1941], p. 259; for the Greek see DK 12 A 15 or Bicknell, pp. 33-34). One must grant that Aristotle's remarks do make such a suggestion. But when they are coupled with the lines immediately subsequent and with texts from Simplicius and Hippolytus, the suggestion fades and another interpretation is possible. In *Physics*, 203b15-26, Aristotle lists five reasons why philosophers believe in the existence of the infinite. The first of these ("From the nature of time – for it is infinite") need not be relevant to Anaximander, and the second ("From the division of magnitudes – for the mathematicians also use the notion of the infinite") certainly is not since such speculation is post-Zenonian (p. 35). The third ("If coming to be and passing away do not give out, it is only because that from which things come to be is infinite") probably does not point to Anaximander because his only extant sentence (the so-called "Fragment of Anaximander") almost "compels us to believe that all change in the world takes place between two sets of opposing constituents and that there is no wastage," and thus *to apeiron* need not be actually infinite but means "qualitatively indeterminate rather than inexhaustibly huge" (p. 34). The fourth reason ("Because the limited always finds its limit in something, so that there must be *no* limit, if everything is *always* limited by something different from itself") is reminiscent of Melissus Fragment 7. The fifth ("Most of all, a reason which is peculiarly appropriate and presents the difficulty that is felt by everybody – not only number but also mathematical magnitudes and what is outside the heaven are supposed to be infinite because they never give out in our *thought*. The last fact – that what is outside is infinite – leads people to suppose that body also is infinite, and that there is an infinite number of worlds": ἀπείρου δ' ὄντος τοῦ ἔξω, καὶ σῶμα ἄπειρον εἶναι δοκεῖ καὶ κόσμοι) would apply to Anaximander if "everybody" is taken literally and would imply "that his *apeiron* was a body of infinite extension surrounding our world, and honey-combed with other worlds" (p. 34). But such literal interpretation seems unnecessary if the other four reasons are connected with later thinkers. Besides, talk of "infinite body" has an Atomistic ring, as does "an infinite number of [coexistent] worlds," not to mention the idea of the void introduced a line later (*Physics*, 203b27) and talk of this *apeiron* as "what is outside." Accordingly, "there is no need . . . to feel compelled by

the fifth Aristotelian *pistis* to posit multiple Anaximandrian worlds in an entity surrounding our own world" (p. 35).

But what of Simplicius (*Phys.* 24. 13, reproduced above as Text I): "Anaximander . . . said that the principle and element of existing things was . . . neither water nor any other of the so-called elements, but some other infinite nature, from which come into being all the heavens and the worlds in them" (ἐτέραν τινὰ φύσιν ἄπειρον, ἐξ ἧς ἅπαντας γίνεσθαι τοὺς οὐρανοὺς καὶ τοὺς ἐν αὐτοῖς κόσμους) and Hippolytus (*Ref.*, I. 6. 1, which is Text II above) "Anaximander . . . said that the principle and element of existing things was the infinite . . . This nature is eternal and unaging and it also surrounds all the worlds" (ταύτην δ' αἰδίων εἶναι καὶ ἀγήρω, ἣν καὶ πάντα περιέχειν τοὺς κόσμους)? The thrust of their comments is, it would seem, indubitably to place in Anaximander multiple worlds, surrounded by the *apeiron*. But one can avoid that thrust if he recalls that "plural worlds are first attested for Leucippus, then for Diogenes of Apollonia who was influenced by him, and subsequently for the rest of the atomists." Yet what do Simplicius and Hippolytus mean with reference to Anaximander? Possibly, this: *ouranoi* are "the rings or tubes of the various heavenly bodies which wheel about the central earth" (with Zeller, Cornford, Guthrie), while *kosmoi* are "the region or regions of the world order framed by them [the *ouranoi*]" (a quotation from Cornford) or "some lower arrangements of atmosphere or earth within the framework of the one and only world system concerning which the testimonia for Anaximander give us any real information" (quotation from Kahn; p. 36). If this view of *ouranoi* and *kosmoi* is substantially correct, then "it is the heavenly rings in the single world which τὸ ἄπειρον περιέχει." The *apeiron* surrounds all the rings individually and, thus, is within the single universe. "The *periechon* is, therefore, an internal environment" (p. 31).

Bicknell now returns to Aristotle, *Physics* 203b10-12: "The infinite . . . is held . . . to encompass all and to steer all" (καὶ περιέχειν ἅπαντα καὶ πάντα κυβερνᾶν). "All" in the quotation refers "to the various intra-cosmic bodies for which the residue of the *apeiron*, left over after genesis, supplies an environment. Aristotle talks about the *apeiron* 'steering' everything, and it is easier to believe that an entity in immediate proximity to the contents of the world could do this, rather than a remote circumambient isolated beyond the cosmic confines" (p. 37). He now joins the points made here with those made previously on Anaximenes.

If, then, the *periechon* is internal and acts from inside the universe and if all of our source references to it can be so explained, any need for postulating an

outer, circumambient *apeiron* falls away. The only use for such would be as a reservoir of substance for the genesis of other worlds, and for Anaximander there are none. It is reasonable to suppose, then, that beyond the sun ring Anaximander's universe came to an absolute stop. The boundary may have been a solid firmament, an aitherial shell, or Anaximander just may not have bothered to describe the periphery of his spherical universe. Anaximenes, on the other hand, needed something solid to which to attach the fixed stars that his predecessor had located between earth and moon. He there retained the mythic *ouranos* [the crystalline substance of which Aetius spoke] (pp. 37-38).

But, more precisely, what did Anaximander himself intend by calling his primal stuff *apeiron*? He did not mean that it was qualitatively indeterminate (although in effect it was no one definite kind of thing; pp. 41, 43), or that it was spherical (which however it actually was because coterminous with the spherical cosmos; p. 41), or that it was infinite "in the sense that moderns talk of infinite space" (p. 39), or that it was without actual boundaries (it terminated at the outer rim of the world and was actually a bit more than "28 earth diameters across"; p. 44). Rather, he termed it *apeiron* as "that which cannot be passed over or traversed from end to end" (with Kahn) because it is so enormous (p. 39). It is "a demythologised version of Chaos" and, thus, its leading characteristic is enormous extension (p. 40), its sole "property is that of being a yawning expanse" (p. 43). But also like Chaos, it "retains a selfmotive power" (p. 41), which produces a world (see pp. 41-43 for details on the stages of cosmogony) wherein it remains as an environment. "When the various world-constituents have been formed and carried into their regular motions by the movement of the *apeiron*, the interaction between the earthly powers of cold, dense, dark and moist and the celestial activities of hot, rare, bright and dry does not, of course, cease." Rather, "each group exerts its powers on its rivals and a cyclic interchange of substance results. But a balance is kept, for each encroachment by one group is immediately avenged by the counter-encroachment of the other. For the opposites locked in this conflict the *apeiron* provides an environment filling the gaps created by the disruption of the concentric spheres of the Hot and the Cold and encompassing all within the cosmic limits." It is itself "devoid of any opposite power and . . . , having been responsible for the formation of the world and being still responsible for the celestial motions, [it] continues to permeate the universe, the environment of the struggling powers, but taking no part in their interactions" (p. 43).

Bicknell finishes his article by asking (among other things) what Anaximenes signified by designating his *arche* as *apeiron*. Mainly, this: *aer*, although finite in extension, was nonetheless vast. It was as big as the

universe itself, which it permeated (p. 47). In fact, "Anaximenes' *aer* is little more than the Anaximandrian *apeiron* under a new label, with the one great difference that it is now involved in the intra-cosmic processes" of condensation and rarefaction (p. 45).

OTHER STUDIES?

The articles of Stokes and of Bicknell terminate our long survey of twenty-three noteworthy studies made of Anaximander's *to apeiron* since 1947. This list is not exhaustive. Besides those which have undoubtedly escaped our notice, there are several which we shall mention without analyzing. One such is Mugler's valuable paper on pluralism, which however refers only briefly to Anaximander.³⁸ Another is Loenen's inquiry, "Was Anaximander an Evolutionist?" which gives data on the Greek philosopher's anthropogony but not on his metaphysics of infinity.³⁹ A third is Martin Heidegger's lengthy and brilliant remarks on Anaximander in *Holzwege*,⁴⁰ which are more helpful for understanding Heidegger himself than the Greek author. As an expert in Heideggerian studies recently and aptly remarked, "Heidegger's analyses of different philosophers in the history of being in the West are not, nor does Heidegger wish them to be, examples of historical treatment in the generally accepted sense of that term."⁴¹ A concentration on Heidegger in another worth-while paper has led to its omission here. Eric Wolf wrote "Der Ursprung des abendländischen Rechtsgedankens bei Anaximander und Heraklit" as a chapter in a *Festschrift* honoring Heidegger on his sixtieth birthday.⁴² In that chapter Wolf intended to set forth Heidegger's own interpretation of the two Greek philosophers, which at that date (1948) had not yet been published. It deserves careful reading for those intent on catching Heidegger's own thought.⁴³ A final article to be passed over is Ramnoux's

³⁸ Ch. Mugler, "Pluralisme matériel et pluralisme dynamique dans la physique grecque d'Anaximandre à Epicure," *RPh*, 35 (1961), 67-86. Mugler mentions Anaximander on pp. 67 and 73. Also see *idem*, "Le retour éternel et le temps linéaire dans la pensée grecque," *BAGB*, 25 (1966), 408-12; *idem*, "Kosmologische Formeln," *Hermes*, 96 (1968), 515-26.

³⁹ J. H. Loenen, *Mnemosyne*, 7 (1954), 215-32.

⁴⁰ (Frankfurt am Main: Klostermann, [3rd ed.] 1957), pp. 296-343.

⁴¹ George Joseph Seidel, *Martin Heidegger and the Pre-Socratics: An Introduction to His Thought* (Lincoln: University of Nebraska Press, 1964), pp. 3-4. Also see Mourelatos, pp. xiv, 64-65, 197.

⁴² *Symposium*, 1 (1948), 35-87.

⁴³ Also see Eric Wolf, "Dikē bei Anaximander und Parmenides," *Lexis*, 2 (1949),

"Sur quelques interprétations modernes de la pensée d'Anaximandre."⁴⁴ As its title indicates, it is a reflection not directly on Anaximander himself but on several modern interpreters: Nietzsche (pp. 234-37), Burnet (pp. 237-39), Guthrie (pp. 240-41), Cornford (pp. 241-44), Jaeger (pp. 244-45) and Heidegger (pp. 245-50).⁴⁵

There is, then, no need to analyze those five studies. For that matter, one possibly need not to be concerned in detail with others which may come to light, since the twenty-three already investigated appear to cover the field pretty well. America, Great Britain, Germany, France, Italy and Australia are all represented. Also, their authors have taken almost every conceivable approach. Some made frontal attacks either by studying Anaximander's position itself (Vlastos, Burch, Kirk, Kahn in his article, Gottschalk, Solmsen, Hölscher, Guthrie, Wiśniewski, Guazzoni Foà, Kraus, Classen) or by directly challenging other interpretations (Cherniss, McDiarmid, Matson, Bicknell). Others inserted Anaximander into the larger context of other questions. For instance, Jaeger was mainly concerned with the nature and origin of the natural theology of the Greeks. Cornford was interested in whether Ionian philosophy was based on directly observed facts and experiments or on *a priori* premises inherited from mythical and poetical cosmogonists. Kahn in his book sought to highlight the unity in early Greek speculation as shown in a continuous tradition of a common set of problems, principles and solutions. Seligman aimed at contributing towards the understanding of speculative philosophy in general by investigating a metaphysics with reference to its key ideas. Cleve wanted nothing less than to wrest the Presocratics from philologists and restore them to philosophers: *Philosophia fiat quae philologia fuit*.

16-24; T. Ballauff, "Interpretationen zu Thales und Anaximanders Philosophie," *TPh*, 15 (1953), 18-70. On the "strange and unpalatable features" which Kantianism and Existentialism insert into the Presocratics, see G. B. Kerferd, *CR*, 17 (1967), 148. For a Marxist approach to Presocratics, see G. Kröber (ed.), *Wissenschaft und Weltanschauung* (Berlin: Deutscher Verlag der Wissenschaften, 1966).

⁴⁴ Cl. Ramnoux, "Sur quelques interprétations modernes de la pensée d'Anaximandre," *RMM*, 59 (1954), 233-52. Ramnoux gives valuable insights into all the scholars surveyed.

⁴⁵ Also see N. Rescher, "Cosmic Evolution in Anaximander," *Studium Generale*, 11 (1958), 718-31, which is valuable for details in the Greek author's cosmogony; Rodolfo Mondolfo, *L'Infinito nel pensiero dell'antichità classica*, and T. G. Sinnige, *Matter and Infinity in Presocratic Schools and Plato*, which have been outlined above in our "Introduction" and to which references will be made in subsequent footnotes; Diego F. Pró, "Interpretacion del Ser en la Filosofia Griega," *Humanitas*, 1 (1953), 42-44; M. Carbonara Naddei, "L'uno-molti nel naturalismo degli Ionici. Prima puntata: da Talete ad Anassimandro," *Sophia*, 36 (1968), 56-97 (see *infra*, Appendix).

Still another motive for here excluding further Anaximandrian studies is that we have already expended an extraordinary amount of time on this opening survey. Let us add, though, that this expenditure seems justified on several counts. It will help to sharpen our own account of Anaximander (see below, Ch. II), who must occupy a place of primacy in any study of infinity in Greece. He is, as Friedrich Solmsen asserted, "the only thinker for whom the *apeiron* itself was the enduring and all-encompassing entity, the power in control of all that comes to pass in the Universe. Several later physicists accepted the concept of infinity from him and gave it a place in their own accounts. But the place is never again the central and dominating one."⁴⁶

Our leisurely survey is also justified as a response to Kerferd's advice that one must be aware of "the ever-increasing body of modern critical discussion" on the Greek texts concerning Anaximander (*CR*, n. s. 17 [1967], 13). Such personal awareness seems almost indispensable if one is to appreciate the widespread interest of contemporary scholars in him, their immense industry and talent, their varied approaches and brilliant insights, the controversies in which they engage. These latter are especially valuable by reminding one of the necessity of continually reading and probing the ancient evidence on Anaximander.

Indeed there is no dearth of controversy about his doctrines, as our analysis of current literature has disclosed. We have seen Bicknell aiming a broadside attack in 1966 on the vulgate interpretation by claiming that *to apeiron* is not outside the universe but is merely a factor within it and coextensive with it. But even those defending the vulgate differ among themselves on many points. For example, Cherniss, Matson and Classen claim that Anaximander was not a theologian at all but only a cosmologist, a natural scientist, a geographer. No, reply Jaeger, Burch and Cornford, his world-view was a genuine theology; at least, he achieved a genuine knowledge of a personal god, add Kahn, Seligman, Gottschalk, Guazzoni Foà, Kirk and Cleve. Again, Anaximander was the first to introduce the term *arché* as a philosophical description for the primal reality (Kahn, Classen, Seligman). No, he merely was the first to posit the *apeiron* as explanatory of the universe (McDiarmid, Kirk). By *apeiron* Anaximander meant that the primal stuff was qualitatively indeterminate (Burch, Wiśniewski, Cleve, Stokes) in fact, this meaning Anaximander had uppermost in mind (Guthrie). Not so (Jaeger, Cornford, Classen). The *apeiron* is a mechanical mixture of ingredients (Jaeger, McDiarmid, Wiśniewski)

⁴⁶ F. Solmsen. "Anaximander's Infinite," p. 114.

or, at least, a chemical fusion (Cornford, Guthrie). No, reply Hölscher, Kahn, Seligman, Gottschalk, Cleve. Aristotle had Anaximander's Infinite in mind when he spoke of *to apeiron* as "intermediate": in some texts yes, affirm Kirk, Kahn, Gottschalk; no, assert Wiśniewski, Classen, Seligman. In the "Fragment of Anaximander" both clauses are quotations from Anaximander himself: Jaeger, McDiarmid, Cornford, Kahn, Guthrie, Cleve. Neither are, assert Kraus and Matson; only the second, affirms Kirk. The *adikia* spoken of in the second clause of the Fragment refers only to the "opposites": Vlastos, Cornford, Kahn, McDiarmid. Jaeger, Burch, Cherniss, Matson, Seligman: it has reference also to individual things, as well as to the worlds which contain them. Still others: it applies neither to individual things nor to the opposites but only to the succession of worlds, the seasons, day-night (Hölscher); it applies only to the expansion of worlds (Cleve following Mondolfo).

Re innumerable worlds: Anaximander does hold an infinite number of worlds, both co-existing and successive (Jaeger, Cherniss, Cleve). In neither sense: Kirk, Kahn, Hölscher, Cornford. Only as successive: Burch, Seligman, Guthrie. *Re* "opposites": rightly understood, they do figure in Anaximander's world-view, affirm Kahn, Guthrie, Gottschalk, Seligman. No, replies Hölscher. Anaximander's *apeiron* is neither merely material nor spiritual (Seligman); it transcends matter and is metaphysical rather than physical (Kraus); although it is not solely material, it is a body (Kahn, Guthrie, Gottschalk). Anaximander's position is, basically, a monism: Guthrie, Gottschalk, Cleve. He is both a monist and a dualist: Seligman. The *apeiron* is spherical in shape: yes, say Cornford and Guthrie; no, say Seligman and Kahn. The expression, *to gonimon*, points to a germ, a seed, an embryo: Guthrie, Kahn. It means, rather, a power or process of producing: Seligman, Classen, Gottschalk, Kirk, Vlastos. The eternal motion engineering the "separating off" of the "opposites" from the *apeiron* is mechanical in nature: Matson, Solmsen. It is vital and organic: Seligman, Classen, Guthrie.

Re Anaximander's own treatise, "Concerning Nature": Aristotle and Theophrastus had a complete copy of it (Gottschalk); they had only a collection of excerpts (Kirk). In their accounts of Anaximander's theories Aristotle and Theophrastus are unreliable witnesses: Cherniss and McDiarmid. Rightly used and carefully interpreted, they are reliable at times: Cornford, Kirk, Kahn, Seligman, Guthrie. On Anaximander in relation to Hesiod and other mythologists: "one cannot think of two Greeks further apart than Hesiod and Anaximander. Anaximander's speculation was not only discontinuous with all mythologizing, but in direct opposition to it

both in method and result" (Matson). Not so: Vlastos, Cornford, Solmsen, Classen, Seligman, Hölscher, Guthrie, Kirk, Gottschalk, Stokes.

In the light of such examples, then, scholars obviously do oppose one another on almost every point concerning Anaximander. Such opposition can be an impediment if it should produce confusion and uncertainty. But it can help if it causes us to read the Greek texts more attentively and if it sharpens our own exposition of his position. But before that exposition let us sketch our procedure for subsequent philosophers.

There can be no doubt that a personal coverage of current literature on them would have the same advantages as on Anaximander. One would thereby experience at first hand a similar interest, industry, talent and variety on the part of scholars. Certainly, also, the literature on them is equally controversial (as will be clear below from the sections on Pythagoras, Parmenides, Zeno, Melissus and the rest). Practically every phrase of their fragments is fought over, almost any conclusion formulated by one interpreter is challenged by another. But one has to contend with limitations of time and space. Hence, I have decided (or, better, am forced) to use the surveys made by others instead of personally studying all the literature (a feat which Kerferd himself believes to be impossible).⁴⁷ This we shall do all the more readily and confidently by reason of the two recent, inclusive and judicious histories already mentioned: G. S. Kirk and J. E. Raven, *The Presocratic Philosophers: A Critical History With a Selection of Texts* (Cambridge: University Press, [4th printing] 1963) and W. K. C. Guthrie, *A History of Greek Philosophy*, Vol. One: *The Earlier Presocratics and the Pythagoreans* and Vol. Two: *The Presocratic Tradition from Parmenides to Democritus* (Cambridge: University Press, 1962 and 1965). Although "we have preferred in many places to put forward our own interpretations," Kirk and Raven warn, "at the same time we have usually mentioned other interpretations of disputed points, and have always tried to present the reader with the main materials for the formation of his own judgment" (KR vii). Guthrie describes his treatises as a history dealing "with a subject of which almost every detail has been minutely worked over many times. What is needed . . . is a comprehensive and systematic account which will so far as possible do justice to the

⁴⁷ In reviewing the years 1953 to 1962, Kerferd remarks: "Books proliferate and articles and discussions in classical and philosophical journals require many pages to list them each year. . . . I am . . . very conscious that I have not seen, let alone read, much that is likely to be of interest or importance – a few such items I mention and mark with an asterisk. But I am sure there are others as deserving of mention as those which I include" ("Recent Work on Presocratic Philosophers," *APQ*, 2 [1965], 130). Also see G, vol. I, p. x.

opposing views of reputable scholars, mediate between them, and give the most reasonable conclusions in a clear and readable form" (G, vol. I, ix).

We shall, then, rely on those reputable histories. To this reliance we shall join reflection upon the available Greek fragments and attention to literature which has come out since those two were published or which may have appeared prior to their publication but of which they take insufficient notice for our purposes. This procedure should enable us to achieve a reasonably accurate and clear understanding of infinity in the Presocratics.⁴⁸

⁴⁸ See above, "Introduction," note 28.

CHAPTER II

ANAXIMANDER AND OTHER IONIANS

After our survey of secondary literature on Anaximander since 1947 and after outlining the methodology for studying his successors, it is now time to set forth our own version of his position.

ANAXIMANDER

Let us begin by recalling the intellectual milieu in which he lived. One of its landmarks was the still lingering influence of ancient mythologies. As a sixth-century Greek Anaximander would be comparatively close to Hesiod's *Theogony* (Vlastos, Solmsen, Classen, Seligman, Kirk, Stokes, Bicknell) and, either directly or indirectly, even to Hittite, Phoenician and other Near-Eastern myths (Hölscher). For obvious reasons one impact these might have upon him, however subtly and unobtrusively, would be that his theory was a cosmogony. It was a sketch of how the universe came about and developed (see above, text VIII; KR 126ff.; G, vol. 1, 89ff.). Moreover, this origin and development were expressed in organic and biological terms, used by mythographers too. *To gonimon* (whether a procreative power or, more likely, the initial product) issues from the *apeiron* and evolves much as does a seed or embryo into eventually the entire universe (Guthrie). To some extent the *apeiron* itself may be a philosophical parallel of Hesiod's Chaos (Classen, Solmsen, Stokes, Bicknell) or, less likely, of the Grecian Okeanos (Seligman) or, even, of Sanchunjaton's "limitless depths" (Hölscher). Again, the *apeiron* is divine (see above, text III). Although it differs from traditional Greek deities in that it not only will have no end but also had no beginning (Kahn), still it single-handedly performs functions distributed to two sets of mythological gods: it both accounts for the origin of the universe and yet controls and steers it also (Gottschalk). Nonetheless, Anaximander's position is not a

religion or a theology (Cherniss, Seligman, Vlastos, Matson; vs. Jaeger, Burch). Yet it is not a pure naturalism or an empirical science either (vs. Matson). It is a philosophical cosmogony headed by a Divinity who is not the center of a cult but who is known by intellectual reflection on various observable facts in the universe as most suitably accounting for that universe. In short, Anaximander is a philosophical theist, a theistic philosopher.⁴⁹

This last point suggests a comment before sketching a second feature in Anaximander's intellectual milieu. The fact that most likely he was open to infiltration by mythological and religious notions conferred a unique character on his thought which makes it hard to categorize and grasp. Although his position is not a mere reconstruction of myths (Gottschalk, Seligman), although it is genuinely a philosophy, still it is not, so to speak, a "pure" philosophy as is Aristotle's or the Atomists' or, for that matter, any other Greek thinker's who is outside the influence of the myths. He asks some questions, elaborates some notions, uses some terms which he would not have done, possibly, had Hesiod and other mythographers not preceded him.

A second feature of the intellectual climate in Anaximander's era was, paradoxically, an absence – an absence of notions, of explicit distinctions, of awareness of problems. For example, no one yet had explicitly conceived of "spiritual." Nor had "moving cause" or "life" yet been contrasted with matter as such. The result is that in interpreting Anaximander one must conclude that his *apeiron* was not merely material but could have some properties of both matter and spirit; that, even though a body, it could be thought of performing functions of a moving cause, could possess eternal motion of an organic sort, could be living and conscious. But one must remember also that it *was* a body, it was material. Accordingly, when later on "spirit," "efficient cause," "life" and so on were explicitly distinguished, then Anaximander's *apeiron*, if described in terms of that distinction,

⁴⁹ This seems accurate: if Anaximander had not yet achieved a full fledged theistic philosophy, at least he was headed in that direction. G, vol. I, 70-71: "If there is any time and place at which we can say that this search for unity [behind the multiplicity of phenomena] emerged from the mythical and entered its scientific phase, it is here in sixth-century Miletus. There is a long way to go. Philosophy is so recently born that it can scarcely stand on its own legs, and only with many a backward glance at its parent and even a grip on her hand; but it is born, because someone has sought the desired unity in a natural substance and removed the gods from the cosmogonical scene." See also U. Hölscher, p. 418; G. S. Kirk, "Sense and Common-sense," pp. 105-117. On the divinity of Anaximander's primal reality, see T. G. Sinnige, pp. 1-14, who believes its forerunner to be the Time-deity of ancient cosmological myths; M. C. Stokes, pp. 31-32; M. de Corte, "Mythe et philosophie," pp. 22-23.

would be more on the side of the material than on that of the spiritual, vital, etc. So too, when "perfection" came to be aligned with "limit" (*peras*), as happened by the time of the Pythagoreans and of Aristotle certainly, then his *apeiron* would itself be more on the side of imperfection and incompleteness (*vs.* Guazzoni Foà).⁵⁰

At Anaximander's time there was also absent an awareness of various philosophical problems with corresponding unawareness of answers – for example, Parmenides' rejection of change, becoming and motion, countered by Aristotle's doctrine of potency/act or by the Atomists' conception of empty space and void. These lacunae have several effects on exegesis.

The first pertains to whether and how the *apeiron* contains the "opposites." Because of their operative presence on the everyday scene (e.g., in a man's health or sickness, his anger or fear; in storms and other meteorological events, seasons of the year), Anaximander would be aware of hot and cold, dry and moist and such like, although not as "elements" in Empedocles' sense (see KR 324, 329) but more vaguely and less technically (Kahn, Lloyd; see above, n. 23). They would be fundamental factors in the physical universe which help explain the condition things are in now and, hence, could aid in accounting for them from and in the very beginning. They were, in short, primal stuffs from which the universe came about. But what was their connection with the *apeiron*, which also is primordial? They were subsequent to it, since it was their source too. This primacy would suggest that they were not in the *apeiron* actually (*vs.* Cherniss, McDiarmid, Cornford, Guthrie), since such actual presence would lessen its causal role⁵¹ and would imply it to be composite rather than simple. Simplicity, some degree of otherness from its products, and priority were characteristics the Infinite must have if it were to be the origin of all.

⁵⁰ This interpretation would also be in conflict with Mondolfo and Sinnige (see *supra*, "Introduction"). It would be in harmony with views stated by Charles Huit, "Les notions d'infini et de parfait," *Revue de Philosophie*, 5 (1904), 738-41; Anna Tumarkin, "Der Begriff des *apeiron* in der griechischen Philosophie," *ASSPh*, 3 (1943), 55-71, especially pp. 70-71, where she develops the point that *apeiron* has a positive meaning only after Plotinus, who was under the influence of *der Transzendenz des religiösen Monotheismus*.

Moving Anaximander's *to apeiron* towards the side of imperfection does not deny that his designation of the first cause as *apeiron* is to apply a perfection to it. If it were limited, it could not perform its unique causal function. But the connection infinity has with perfection is tenuous, since later philosophical thinking will conceive perfection as limit. On this conception in the Pythagoreans, see P. Kucharski, "L'idée d'infini en Grèce," *RS*, 34 (1954), 12-13 and 17-18; Ch. Mugler, "Pluralisme matériel," pp. 67-68. Also see G, vol. I, 242; *infra*, "Conclusions" to "Melissus" section.

⁵¹ On its causality, see below, pp. 63-65.

If not actually there, were the “opposites” potentially present? Potential existence would not clash with the Infinite’s unity and priority and could agree with its status as material and living. However, such a manner of presence would consistently point to some sort of change by which the potential becomes actual and this, in turn, would demand that the Infinite be the substrate within which such change takes place. But all of these conceptions were explicated only by Aristotle to solve Parmenidean problems. Hence, Anaximander could hardly have had “potential existence” in mind when thinking of the *apeiron* and the opposites.

Most likely, he did not conceive of the “opposites” as present within the *apeiron* at all. This self-animated mass produces them and, thus, is itself neither hot nor cold, neither dry nor moist. It is simply other than them all because it is their origin. It is without any definite characteristic, it is indeterminate. The opposites are no more in the Infinite than are seeds in trees or children in parents prior to flowering or conception (Kahn, Gottschalk).⁵²

Still another exegetical result follows Anaximander’s unawareness of the Eleatics and of the reply given this time by the Atomists. An aftermath of the early monists’ identification of all being with material *physis* was, Parmenides argued, that what is not body cannot exist and, thus, empty space is non-existent. Leucippus and Democritus countered by asserting that empty space does exist. It is distinct from any form of body, is strictly infinite in extension and provides the locale wherein innumerable worlds come to be and pass away (G, vol. I, 113-14; KR, 122-25; Cornford, *Prin.*, p. 177). Now, if admission of an endless number of worlds (whether simultaneous or successive) depends upon a doctrine of infinite space, then the absence in Anaximander of this latter theory is a clue that he did not posit innumerable worlds (unless, of course, he had intuitively jumped beyond himself to the Atomists’ theory, as he actually did transcend his

⁵² The first cause of some subsequent philosophers also did not contain the perfections of its effects. For example, Plotinus asserted that the One gives but does not himself possess what he gives (*Enneads*, VI, 7, 15, 17-18; VI, 7, 13, 3 sq.; III, 8, 10, 15 sq.; IV, 4, 45, 18 sq.). This assertion was grounded in Plotinus’ highly articulated metaphysics, where reality is unity. Anaximander’s metaphysics was not such, at least explicitly. Accordingly, if Anaximander excluded the opposites from the *apeiron*, it was not due to this. Rather, it was simply that “they were no more pre-existent in the *apeiron* than children pre-exist in the body of their parents before conception . . . He accepted as an unquestioned fact that one thing could arise out of another [without being contained by the other], as day arises out of night and spring out of winter, and he expressed this fact in the most significant way he or any man of his time could imagine, by analogy with the generation of living things” (Kahn, pp. 236-37).

own times by viewing the world as needing no support because of its equal distance from everything else; G, vol. I, 99-100 and 388-89).

Having sketched two features of Anaximander's intellectual environment and the light each throws on his thought, let us attempt to describe the *apeiron* itself. But first we must choose between Bicknell's and the vulgar interpretation of where it is located. This Australian scholar, as we saw previously from our analysis of his article, "*To apeiron, apeiros aēr and to periechon*," *Acta Classica*, 9 (1966), 27-48, has decided that Anaximander's *arche* does not extend beyond the universe which it produced and, hence, "surrounds" (περιέχει) it only as the internal environment of its parts. It is, then, *apeiron* only because the expanse between the boundaries or limits which it actually has is so enormous (p. 44: "something over 28 earth diameters across") as to be virtually intraversable. Apparently Bicknell bases his decision mainly upon one consideration: the words οὐρανοί and κόσμοι, which figure in Simplicius' and Hippolytus' accounts of Anaximander's doctrine (see *supra*, Ch. I, Texts I and II), do not refer to the outer heavens and to multiple worlds but to components within a single world. Hence, when the Milesian philosopher is reported to have affirmed that the infinite πάντα περιέχει τοὺς κόσμους (Hippolytus) and that it περιέχει ἅπαντα (Aristotle *Physics*, 203b11), he intended only that *to apeiron* encompasses and moves the interior parts of the universe as their internal environment. There is no need for an outer, circumambient *apeiron* and, accordingly, there is none.

What should be one's reaction to Bicknell? Everyone realizes of course that the texts from Aristotle, Simplicius, Hippolytus and so on are reports of Anaximander's doctrine and, hence, may not be expressed in his own words but in the Greek of later eras and may mingle subsequent and alien notions with Anaximander's own. But, even so, some of Bicknell's inferences are unsatisfactory. "*Ouranoi* and *kosmoi* indicate parts of Anaximander's single world and, therefore," he concludes, "his *apeiron* is solely an inner environment of that world." But others (e.g., Cornford, Guthrie, Kahn) accept that meaning of the two words and find no evidence of multiple co-existing worlds in the Milesian; still they do not draw Bicknell's conclusion. In fact, he himself admits that, even though "we ought to say that it is the heavenly rings [and other parts] in the single world which τὸ ἄπειρον περιέχει," still "the expression might, I suppose, mean that the *apeiron* surrounds them collectively, lying beyond all the *ouranoi* and *kosmoi*" (p. 37), which obviously is the vulgar position.

Again, scholars (e.g., Kirk, Guthrie, Cornford, Seligman, Gottschalk) have refused to see in Anaximander's *to apeiron* a strict and actual infinity

in space. Rather, his *arche* is infinite because, although it is actually finite as ultimately limited and within bounds, its extent is still enormous and intraversable: it is “simply of an indefinite quantity large enough to serve as source or reservoir from which all that exists has been drawn” (Guthrie, vol. I, 82). In this, then, they would agree with Bicknell without apparently feeling any necessity of confining *to apeiron* within our universe.

Moreover, some experts view *to apeiron* as encompassing the world but believe that it permeates the world too. As Guthrie observes in his article on “The Presocratic World-Picture” (*HThR*, 45 [1952], 88),

Anaximander had already advanced to the view that it [the earth] would float freely in space without the need of any material support. Within the sphere, at different levels, the sun, moon and planets move in their orbits.

Beyond the cosmic sphere . . . there was very far from being nothingness. It floated, as it were, in a circumambient substance of infinite, or at least of indefinite extent. This substance was of a purer, higher nature than those which made up the contents of the kosmos itself . . . In its pristine purity and perfection, it existed only outside the kosmos, but – what is of the highest importance for religion and philosophy alike – in more or less adulterated form it penetrated the kosmos and was mingled with its creatures.

There is, then, no necessary conflict between Anaximander’s *arche* permeating the world and yet simultaneously surrounding it also.

This fact, when joined to the two previous considerations, reveals that Bicknell has rested his case upon tenuous and inconclusive grounds. This becomes even more apparent when one rereads the crucial sentences in Aristotle, *Physics* 203b11 (καὶ περιέχει ἅπαντα καὶ πάντα κυβερνᾷ) and Hippolytus, *Refutatio*, I.6.1 ([ἀρχὴ] ἣν καὶ πάντας περιέχειν τοὺς κόσμους. Even Bicknell grants the truth of the objection “that the words τὸν κόσμον περιέχει do not suggest an internal environment” (p. 32). Although περιέχειν entails the notion of control, as F. Solmsen has stressed (“Anaximander’s Infinite,” esp. pp. 112-13), still its basic meaning is “to be around [something]” or, like ἐν ἑαυτῷ ἔχειν, “to include in oneself” and, thus, to encompass, embrace, surround, comprehend (see Liddell and Scott, s.v.). Hence, the best understanding of Aristotle and Hippolytus appears to be the literal and natural one: Anaximander’s *arche* surrounds all things and the world itself as a circumambient *apeiron*.

This interpretation, we may add, is perhaps corroborated by Pseudo-Plutarch’s account of Anaximander’s cosmogony. “The *apeiron*,” he reports in *Stromateis*, 2 (Text VIII above), “contained the whole cause of the coming-to-be and destruction of the world, from which he [Anaximander] says the heavens are separated off, and in general all the worlds, being innumerable” (ἐξ οὗ . . . ἀποκεκρίσθαι). Moreover, “he [Anaximander]

says that that which is productive from the eternal of hot and cold was separated off at the coming-to-be of this world" (τὸ ἐκ τοῦ αἰδίου γόνιμον . . . ἀποκριθῆναι; translation from KR 105-106 and 131; for the Greek see DK 12 A 10 or KR, *loc. cit.*). If the *ouranoi* and all the *kosmoi* (whether taken as components of one universe or as separate multiple universes) are "separated off" from the infinite, if what produces hot and cold is "separated off from the eternal" (see KR 129-33 and G, vol. I, 89-93, for discussion of "separating off" and *to gonimon*), might not such a process of separation (so to speak) push the *apeiron* outward and its products inward? As Bicknell himself says, p. 43: "We now have three concentric spheres. The Hot around the Cold and the *apeiron* around both, and all turning with the original rotary motion of the *apeiron* now imparted to its products." The result would be that their *arche* precisely as moving cause would be distinct from them and yet enclose them.

However strong (or weak) this last reflection is, it should be clear from it and preceding paragraphs that we prefer the vulgate location of *to apeiron* as the circumambient *arche* of reality to Bicknell's view, which he modestly admits to be "as conjectural and as fraught with difficulties as any other" (p. 47).

Our preference will manifestly have repercussions on our understanding of what Anaximander himself intended by designating his *arche* as *apeiron*. In order to answer that question let us, as Anaximander himself most likely did, take stock of the visible universe within which we are: sun, moon and other heavenly bodies; the earth with its soil and seas, its contrasts of calm and storm, its seasonal changes; the men, animals and plants which inhabit it. Let us then project ourselves back to its primal sources: the hot and the cold (or, if you prefer, fire and moist air) and the other "opposites." But these too, because multiple and in conflict, need to be accounted for and, hence, let us step still further back to their single source. This is what Anaximander calls *to apeiron*. As their common origin, it is unlike any one of its primal (or, for that matter, subsequent) products. It is neither hot nor cold, neither dry nor moist. It is, in a word, indeterminate, *aoriston* (Simplicius, *In Physicorum*, 24, 28). It is simply dissimilar to any of the sensible things we know. Of its nature we can only say: it is such as to be that from which the "opposites" and posterior effects arose, which surrounds the visible universe they constitute, which somehow guides it.⁵³ As origin of our tremendous and varied

⁵³ Gottschalk even goes so far as to say that it is without any sensible qualities whatsoever: "Anything infinite, or even anything large enough to surround all things and to be their source, must be completely impartial. It was not enough that

universe, it must be inexhaustible in resources, as well as itself without origin and terminus: it is indestructible, immortal, ageless and, for that reason, divine. As encompassing that universe, it must be a huge body also – in fact, so large that it is immeasurable, intraversable: no one can arrive at or even know its limits. As the circumambience of reality, it has nothing outside which might contain it.

To apeiron, the title our Greek philosopher bestows upon the *arché* in his world-view, has all those meanings. It is indeterminate, inexhaustible, everlasting, intraversable, and without any extrinsic limit.⁵⁴

A few other attributes can be inferred from the functions Anaximander ascribes to his first principle. It is a living body because it separates off its initial product (*to gonimon*) by an eternal motion (texts II, VII) – expressions which connote life and self-movement.⁵⁵ The fact that it guides or steers the universe (text III) implies it to have awareness, knowledge,

it should be different from any of the obvious *dynamēis* such as the hot or the cold, light or darkness. It could not have any sensible qualities at all, any more than the atoms of Democritus. It could only be described as the source of all things, everlasting and indescribably vast: these were its only properties. Like the atoms, it was a metaphysical construction, devised to account for the origin of the world. Anaximander's originality lay in his ability to conceive such a thing without clothing it in mythical attributes" (p. 48). Or Guthrie, vol. I, 78: "With Anaximander physical theory takes a momentous step, to a notion from which it has retreated many times before its reappearance in very different form in the modern world: the notion of the non-perceptible." Instead of the elemental masses visible in the world of today, he "posited an unnamed substance behind them all, less definite in character, which he described as *apeiron* . . . The original matrix of the universe must be something more primitive and ultimate than any of them, of which they are all alike secondary manifestations or modifications." See also Burch, pp. 142-44; Seligman, p. 54, for whom *to apeiron* transcends both matter and spirit; Kraus p. 378; G. S. Kirk, "Sense and Common-sense," p. 107; H. Fränkel, *Wege und Formen*, p. 189 ("... das *apeiron*, das Unbegrenzt-Indifferente"); M. C. Stokes, VIII, 32-3; P. J. Bicknell, pp. 41, 43.

⁵⁴ There is no information indicating that Anaximander considered the first cause to be spherical in shape and, thereby, infinite (*vs.* Cornford; T. G. Sinnige, pp. 11 and 112; P. J. Bicknell, p. 41). Did he intend *apeiron* to signify "what cannot be experienced or perceived"? This has been suggested by Paul Tannery, "Pour l'histoire du mot 'apeiron'," *Revue de Philosophie*, 4 (1904), 703-7; A. Tu-markin, "Der Begriff des *apeiron*," pp. 55-71; R. M. Agoglia, "Indeterminación óntica y equilibrio ontológico en Anaximandro," *Rev. de Filos. de la Univ. Nacional de la Plata*, 18 (1967), 7-19 (for comments, see H. J. Padrón, "Acerca de una nueva interpretación del fragmento de Anaximandro," *Philosophia*, 34 [1968], 79-86). According to Gottschalk (p. 48), *to apeiron* does not have any sensible qualities (see above, n. 53). In the view of Guthrie (vol. I, 78), it is imperceptible. Likely enough, then, Anaximander can intend nonexperiential, imperceptible, incomprehensible as one meaning of *apeiron*. It is not its sole meaning, though.

⁵⁵ See Gottschalk, pp. 46-47: "It would appear that Anaximander imagined the formation of the world as an organic process like the growth of a plant or embryo, and the *Apeiron* as something capable of producing seed; both ἐκκρίνεσθαι and

consciousness of some sort (KR 115-16; Cleve, 156-57; Kerferd, p. 133). As the living source and cognitive guide of the universe, it is also its cause. But what sort of cause? This important and difficult question leads to another: is the Infinite really distinct from its products or identical with them? Is Anaximander's world-view a monism or a dualism?

According to W. A. Heidel, "Anaximander's *apeiron* was an ἀρχή καὶ πηγή lying about the world, from which it drew its sustenance (breath), into which it finally yielded up the 'ghost'." ⁶⁶ For Guthrie, the *apeiron* seems to be a constitutive part of the universe and, thus, almost one of its intrinsic causes.

The "new understanding of the world" [effected by the Milesians] consisted in the substitution of natural for mythological causes, that is, of internal development for external compulsion. This, as Pohlenz says ["Nomos und Physis," *Hermes*, 91 (1963), 426], is well expressed by the generalized use of *physis*, which is something essentially internal and intrinsic to the world, the principle of its growth and present organization, identified at this early stage with its material constituent. The primary assumption is not simply that it consists of a single material substance, but that the diversity of its present order is not from eternity, but has evolved from something radically simpler at a particular point in time (vol. I, 83).

Or again:

In its pristine purity and perfection, it [the first substance] existed only outside the kosmos, but . . . in more or less adulterated form it penetrated the kosmos and was mingled with its creatures. ⁵⁷

Others, though, affirm the distinctness of the *apeiron* from its products. For F. Solmsen "Anaximander's *apeiron* is not *within* the world, and . . . no true Infinite could ever be a part of the world." ⁵⁸ Anaximander's philosophy, Seligman asserts (pp. 54-55), "is monistic because there is one single originating "principle"; nevertheless it is "dualistic in as far as

ἀποκρίνεσθαι were regularly used of the bodily secretions, and could have had this sense in Anaximander's book." Also see G, vol. I, 90-91.

On eternal motion, see KR 128: "For Anaximander change in the cosmos was bound up with the divinity, the power of life and movement, of the Indefinite . . . The Indefinite was divine, and naturally possessed the power to move what and where it willed." Also see Cornford, pp. 178-79; Hölscher, pp. 266-67; Kahn, pp. 39-42, 237-38; Classen, pp. 167-68; Seligman, pp. 53-56; G, vol. I, 87-89; KR 126-33.

⁵⁶ "On Anaximander," *CP*, 7 (1912), 228. The entire article (pp. 212-34) is valuable.

⁵⁷ W. K. C. Guthrie, "The Presocratic World-Picture," p. 88. Also see P. Kucharski, "L'idée d'infini," p. 6; P. J. Bicknell, pp. 33-44 (analyzed above).

⁵⁸ "Chaos and *Apeiron*," p. 245.

there is a decisive distinction between 'principle' and nature, between the everlasting *apeiron* and the things that come-to-be and must pass away." F. M. Cleve (pp. 157-58) asks what relation exists between the divine *apeiron* and the infinitely numerous worlds, which are also divine. They are distinct, he replies, and "this would then be – for the first time in Greece – the distinction between many, in fact innumerable, born and mortal, though long-living gods and the one eternal Lord." But each of the infinitely numerous born and mortal gods is a whole world and "all these god-worlds, or world-gods, are embedded, while they last, in the one infinite and immortal god, themselves being temporary transformations of parts of that infinite and undefinable eternal godhead." In his article, "Pluralisme matériel et pluralisme dynamique dans la physique grecque," Ch. Mugler makes the point that under the apparent monism of the Ionians there lurks both a material and a dynamic pluralism.⁵⁹

Scholars differ, then, on the relationship between the *apeiron* and the world. Some connect them intimately, perhaps even to the point of identification. Others find them distinct. What is to be said? As a corporeal mass, the Infinite is the initial and (possibly) continuing⁶⁰ source whence things derive the "stuff" which makes them be what they are. Thus things are closely connected with it and dependent on it. But that source is also what later philosophers will call an efficient cause, which is living and intelligent, which separates them off by an eternal motion, which steers the universe. Accordingly, there would entitatively be a real otherness between them and the *apeiron* as between any effect and the agent which made it. Anaximander's world is, then, monistic only insofar as it has a single originating principle and both it and its principle consist of the same sort of "stuff" (which however is found in the *apeiron* in an indeterminate fashion but in things in a determinate manner).⁶¹ It is not a monism in the sense that things are really identified with their source. However intimately associated they may be, product and cause are genuinely different. Just as an infant is derived from and nursed by his mother, who nonetheless is distinct from him, so the entire visible universe is derived

⁵⁹ Pp. 67-86.

⁶⁰ It does surround the universe – see texts II, III and pp. 59 sqq. above (vs. Bicknell); Solmsen, "Anaximander's Infinite," pp. 110-12, 115-19.

⁶¹ Such is the definition J. M. Rist gives "monism": the search "for a single cause of the universe, some substance or *arché*, as they [the Milesian philosophers] called it, from which all things were derived and of which they are all in some sense composed." See "Monism: Plotinus and Some Predecessors," *HSCP*, 69 (1965), 329.

from and nourished by the Infinite, which nevertheless is distinct from it.⁶²

Such, then, is the first cause in Anaximander's universe: a physical, self-moving, intelligent and divine existent, who is both nurse and agent of the universe and who also is infinite. What will keep his philosophical position unique for a good number of centuries is not the fact that his originative and efficient cause is corporeal or living or intelligent or, even, divine: subsequent thinkers will predicate those adjectives of their first principles. It is, rather, that his primal cause is by nature the Infinite, the Boundless, the Limitless. To quote Solmsen again:

Anaximander is the only thinker for whom the *apeiron* itself was the enduring and all-encompassing entity, the power in control of all that comes to pass in the Universe. Several later physicists accepted the concept of infinity from him and gave it a place in their own accounts. But the place is never again the central and dominating one In good philological language we may say that the *apeiron*, instead of continuing to be the subject, comes to find itself in the position of an adjective or predicate. I should of course not press this observation to the point of maintaining that after Anaximander it could never again be used as subject. Still, the trend of the development will be clear. In the later thinkers it was entities other than *apeiroi* that occupied the place of the principle. . . ; those who believe in infinity would either attach this concept to one of those other entities or set up some other kind of relationship between the *apeiron* and the pivotal ideas of their system ("Anaximander's Infinite," pp. 114-15).

When one realizes that Anaximander links *apeiron* with perfection (albeit nebulously and tenuously – see note 50) and also applies it to a deity, then the achievement of our Greek philosopher is enhanced. His is a god whose very reality is infinite, unlike the first principle in a Pythagorean *Weltanschauung* or in Plato and Aristotle but (allowances made for all the vast differences, too) similar to Plotinus' and, even, to the Christian conception of God after 1250 A.D.

ANAXIMENES, XENOPHANES, HERACLITUS

Subsequent Ionians can, we hope, be handled briefly without detriment to accuracy because they seem to share with Anaximander and most

⁶² One should note that some cosmogonical stages Anaximander described clearly enough, others unclearly. The initial moment is unclear – see text VIII and references to Gottschalk and Guthrie in note 55, first prgr. Those two scholars differ from Kirk, who prefers *to gonimon* to have been not the opposite substances themselves (flame and mist) but something that produced them, such as a vortex (KR 130; see N. Rescher, "Cosmic Evolution," pp. 721-22). Also see F. Solmsen, "Chaos

thinkers of the sixth and fifth centuries "a common picture of the nature of the Universe, of living creatures, and of divinity."⁶³ The salient features of that world-picture would be these.

There is the cosmic sphere, bounded by the sky, with the earth at its centre, the fixed stars at the circumference, and the sun, moon and planets circling in between. The contents of this cosmos are subject to change and dissolution, being mainly composed of elements or qualities which conflict, and prey upon each other. But the cosmos is not the whole of reality. There is also "that which surrounds," a quantity of the untransformed primal substance or *arche* which for some at least of the Presocratics was infinite or indefinite in extent. This was of a purer, higher nature than the "opposites" within the cosmos, which had in some way been "separated out" or "condensed" from it. It was everlasting, alive and active, itself the initiator of the changes which formed the cosmos, which it not only surrounded but directed or "steered." It was in fact divine (G, vol. I, 470).

Despite individual variations Anaximenes, Xenophanes and Heraclitus would seem to subscribe to that *Weltanschauung*.⁶⁴ Since we already

and '*Apeiron*,' p. 248: "The separation of the basic qualities came to pass neither in the *apeiron* nor even in the first stage on the way from *apeiron* to Cosmos. We read that a nucleus pregnant with the opposites detached itself from the *apeiron* and it was only when this nucleus split up that the hot and cold, bright and dark stuff became separated that these opposites took up different places." On the meaning of *ouranos* and *kosmos*, see J. Kerschenshtainer, pp. 25-59, esp. 38-44.

Subsequent moments (formation of earth, encircled by vapor and flame; development of heavenly bodies; origin of animal and human life; meteorological phenomena) are more clearly depicted. They occur through the natural exercise of powers which the mutually hostile opposites have: heat dries up moisture and so on. It is a continuation of the process of "separating out" through the action of the hot and dry on the cold and moist. See G, vol. I, 92-106; KR 133-42; N. Rescher, "Cosmic Evolution," pp. 721-29; P. J. Bicknell, pp. 41-44.

On whether the world will end by fading into the *apeiron*, see G, vol. I, 100-101; KR 140. This seems certain: the first clause of the celebrated Fragment of Anaximander ("Things perish into that out of which they have their being") refers not to the world but to the opposites (*re* their transformation into one another) and/or to individual things (men, animals, plants, whose dying balances their birth). See G, vol. I, 100; Kerferd, 133; Kahn, 166-98; KR 118-21; H. Fränkel, *Wege und Formen*, pp. 187-88; O. N. Guariglia, "Anaximandro," pp. 102-51.

⁶³ W. K. C. Guthrie, "The Presocratic World-Picture," p. 87. The entire article, pp. 87-104, can be read with profit.

It will be helpful for succeeding paragraphs to recall that Thales, Anaximander, Anaximenes, Xenophanes and Heraclitus can all be called "Ionians" because all are from the district of Ionia. Only the first three are "Milesians," though, since they alone are from the city, Miletus.

⁶⁴ There is controversy as to whether or not Anaximenes and Heraclitus should be listed here. See section above on M. C. Stokes and P. J. Bicknell, who hold that Anaximenes' *aēr* is coextensive with the world; on Heraclitus see below, final prgrs. of this section.

understand it by our study of Anaximander, we can take it for granted and concentrate on their views on infinity.

Anaximenes of Miletus was active about the middle of the sixth century.⁶⁵ Information on his doctrines is furnished by (among others) Simplicius, Hippolytus and Aëtius.

Text I: Simplicius, *Commentary on Aristotle's Physics*, 24, 26 (DK 13A5; G, vol. I, 121): Anaximenes of Miletus, son of Eurystratus, the companion of Anaximander, also posits a single infinite underlying substance of things, not, however, indefinite in character like Anaximander's but determinate, for he calls it air, and says that it differs in rarity and density according to the different substances. Rarefied, it becomes fire; condensed, it becomes wind first, then cloud, and when condensed still further water, then earth and stones. Everything else is made of these. He too postulated eternal motion, which is indeed the cause of the change.

Text II: Hippolytus, *Refutatio*, I, 7, 1 (DK 13A7; G, vol. I, 121):

Anaximenes, another Milesian and the son of Eurystratus, says the *arche* is infinite air, out of which proceeds whatever comes to be or has done so in the past or will exist in the future, gods also and the divine. Everything else is made from its products. Now in form the air is like this: when it is most evenly distributed, it is invisible, but it is made visible by hot and cold and wet and movement. It is in constant movement, otherwise the things which change could not do so. It assumes different visible forms as it is rarefied or condensed. When dispersed more finely, it becomes fire. Winds on the other hand are air in process of condensation, and from air cloud is produced by concentration. The continuation of this process produces water, and still further condensation earth, while stones are the most condensed form of all. Thus the most important features in genesis are contraries, hot and cold.

Text III: Aëtius, I, 7, 13 (DK 13A10, KR 150):

Anaximenes (says that) the air (is god): one must understand, in the case of such descriptions, the powers which interpenetrate the elements or bodies.

Text IV: Aëtius, I, 3, 4 (DK 13 B2; G, vol. I, 131):

Anaximenes of Miletus, son of Eurystratus, declared that the origin of existing things was air, for out of it all things come to be and into it they are resolved again. "Just as our soul," he says, "which is air, holds us together, so breath and air surround the whole cosmos." Air and breath are used synonymously.

Text V: Simplicius, *op. cit.*, 152, 22 (DK 64B7; G, vol. I, 130 and KR, 435 [this text concerns the doctrine of Diogenes of Apollonia, who took up in the fifth century (*fl.* 440-430) the doctrine of Anaximenes that air was the primary substance]:

In my opinion that which has intelligence is what men call air, and by it everything is directed, and it has power over all things; for it is just this substance which I hold to be god and to have reached everywhere and to dispose all things and to be in everything. And there is no single thing that does not have a share of this.

⁶⁵ See G, vol. I, 115; KR 143-44; G. B. Kerferd, "The Date of Anaximenes," *MH*, 11 (1954), 117-21.

Anaximenes is a good illustration of Solmsen's point that after Anaximander *apeiron* no longer occupied a central and dominating place in philosophy ("Anaximander's Infinite," pp. 114-15, quoted above). The *arché* from which all things come to be and into which they are again resolved (text IV) is air (ἀήρ; see G, vol. I, 126-27 and KR 116 for the force and history of the Greek word). It is invisible when most equably distributed. It is made visible when affected by hot and cold and wet and movement (text II): when rarefied, it becomes fire; condensed it becomes winds, then clouds, water, earth and stones and from these the entire world is made (texts I, II). Source of everything past, present and future (text II); surrounding and holding together the cosmos as a soul does a living body (text IV; but see P. J. Bicknell, pp. 31-3); endowed with eternal motion whence comes change (text I); intelligent so as to guide and control all (text V);⁶⁶ immortal and incorruptible,⁶⁷ this *arché* is divine (text III).⁶⁸ It is also *apeiron* but, unlike Anaximander's, it is not *to apeiron*. It is infinite, it is not the Infinite: by nature it is air, and infinity is one of its characteristics only.

What does this characteristic signify when predicated of Air? It retains several of its Anaximandrian meanings. *Apeiria* points to the inexhaustibility of air as source and sustainer of the universe, to its perpetuity, to its immensity and intraversability, to its freedom from containment within anything else. But it no longer can mean indetermination. As Theophrastus speaking through Simplicius indicates explicitly (text I): "Anaximenes' *arché* is not indeterminate in character like Anaximander's but determinate, since he identified it with air" — μίαν μὲν καὶ αὐτὸς τὴν ὑποκειμένην φύσιν καὶ ἀπειρόν φησιν ὥσπερ ἐκεῖνος, οὐκ ἀόριστον δὲ ὥσπερ ἐκεῖνος ἀλλὰ ὀρισμένην, ἀέρα λέγων αὐτήν.

This identification can seem a philosophical retrogression if viewed as a refusal of Anaximander's insight that the source of immediate, percept-

⁶⁶ In using this text of Diogenes for information on Anaximenes, I am following the example of G, vol. I, 129-30; G. Vlastos, "On Heraclitus," *AJP*, 76 (1955), 363-64, n. 55, who calls Diogenes "Anaximenes' close follower." Also see J. Hueffmeier, "Teleologische Weltbetrachtung bei Diogenes von Apollonia," *Philologus*, 107 (1963), 131-38.

⁶⁷ This point is made by Aristotle, *Physics*, 203b7-15 (see above, Ch. I, "Ancient Sources [on Anaximander]," text III), who considers what is stated there to apply to most natural philosophers, of whom Anaximenes would certainly be one.

⁶⁸ The final words of text III in the present Chapter ("the powers which interpenetrate the elements or bodies") are a Stoic way of describing what Anaximenes' doctrine seems actually to have been. See KR 150-51; M. C. Stokes, p. 28. On Text IV, see J. Longrigg, "Note on Anaximenes' Frag. 2," *Phronesis*, 9 (1964), 1-4.

ible, definite, conflicting things must be something primordial, non-perceptible, indefinite, neutral (see G, vol. I, 116). Nevertheless, Anaximenes' refusal also was an advance on two fronts. In his theory of rarefaction and condensation as an explanation of how air develops into fire, water, earth and the rest, he hit upon a rational account of how an *arché* could remain the same substance and still become all other things (G, vol. I, 116, 119-20).⁶⁹ Secondly, rarefaction and condensation are verifiable natural processes, which permit apparent differences of kind or quality to be reduced to differences of quantity. This reduction not only safeguarded the unity of the primary substance (air) by equating all diversity in things with the presence of more or less of it in a given space (G, vol. I, 119-20, 125-26, 139-40). It also suggested that eventually "physical phenomena – colour, sound or whatever it may be – can be expressed in the form of mathematical equations – in other words, that all differences of quality are reducible to differences of quantity, and only when so reduced can be regarded as scientifically described." This is the assumption on which all modern physical science is based (G, vol. I, 127).

Apeiron plays an even less significant role in Xenophanes of Colophon (ca. 570-470). In fact, this Ionian poet-philosopher postulates no *arché* at all, since the cosmos, which is a spherical, living and conscious body, is everlasting and, hence, needs no source infinite or otherwise.⁷⁰ Actually,

⁶⁹ This theory also emphasizes the monistic dimension of his views, which results from the close alignment and, even, identity of things with air. But since air is also eternally moving and intelligent, it also is an agent and, thus, is other than its products. This otherness seems downplayed in favor of the monism, though. See above on Anaximander, pp. 63-65. For a survey of Anaximenes' doctrine, see M. de Corte, "Anaximène," *LThPH*, 18 (1962), 35-58. On p. 47 he stresses that condensation and rarefaction are not "un processus mécanique" but "organiques ou psychophysiques."

⁷⁰ Occasionally a doxographer will apply *apeiron* to Xenophanes' cosmos (e.g., Nicolaus of Damascus). Aristotle implies that Xenophanes did not distinguish between finite and infinite (see G, vol. I, 368-69 and 379-80). But, as Guthrie remarks (p. 378), "all the soberer accounts have 'spherical and finite,' and they must be believed." But see T. G. Sinnige, pp. 18-28.

See F. M. Cornford, *Principium Sapientiae*, pp. 146-47: "The round world is a living creature endowed with consciousness or, in ordinary language, a body animated by a soul co-extensive with it. Its body is finite and spherical. The god is eternal, for gods are universally held to be 'immortal and imperishable,' and this, as we have seen, implies that they have no beginning of existence. Accordingly, since this god is the world, there is no cosmogony, whereas Anaximander has endowed his 'boundless' with the divine attributes, and then generated out of it a perishable world. There is no such divine substance extending beyond the world and enveloping it, or breathed in by it, as the Pythagoreans supposed. The divine epithets belong to the world itself." But see Loenen, p. 29 and n. 54. On Xenophanes see also these entries in the Bibliography below: Corbato, Herzog, Tarán, Zeppi.

the cosmos *is* god and Xenophanes' position is basically a pantheism (G, vol. I, pp. 381-83; Kerferd, 135). Does he predicate *apeiron* of anything? Yes, of the earth, the suns and moons.

Text I: Hippolytus, *Refutatio*, I, 14, 3 (DK 21A33; KR 172):

The sun comes into being each day from little pieces of fire that are collected, and earth is infinite (*apeiron*) and enclosed neither by air nor by the heaven. There are innumerable (*apeirous*) suns and moons, and all things are made of earth.

Text II: Aëtius, II, 24, 9 (DK 21A41a; KR 173):

Xenophanes said there are many suns and moons according to regions, sections and zones of the earth, and that at a certain time the disc is banished into some section of the earth not inhabited by us, and so treading on nothing, as is were, produces the phenomenon of an eclipse. The same man says that the sun goes onwards endlessly (*eis apeiron*), but seems to move in a circle because of the distance.

Text III: Achilles, *Isagoge in Arati Phaen.* 4 (Maass, 34, 11; G, vol. I, 394; KR 175):

At our feet we see this upper limit of the earth coterminous with air, but underneath it stretches without limit (*es apeiron*).

What does such predication signify? The earth is *apeiron* (text I) most likely in the sense that it is not enclosed by air or heaven. It seems to stretch downwards indefinitely (text III) because there is nothing beneath it, neither water (*vs.* Thales) nor air (*vs.* Anaximenes) nor Tartarus (*vs.* Hesiod). Unlimited by such things, it extends down to the bottom of the cosmic sphere.⁷¹ Suns and moons are innumerable (text I) presumably because they are fires kindled anew each day from ignited clouds and this process goes on endlessly, day after day. The sun seems to go on endlessly (text II) because its daily journey across the sky from east to west is immense (KR 173-76).

Finally, *apeiron* is excluded from the universe of Heraclitus of Ephesus (*fl. ca.* 500 B.C.), who actually considers fire, the heart of reality, to be finite.

Simplicius, *In Phys.*, 23, 33-24, 4 (G, vol. I, 457): Hippasus of Metapontum and Heraclitus of Ephesus also believed the substance of the universe to be single, in motion and finite (*hen . . . kai kinoumenon kai peperasmenon*); but they posited fire as the *arche* and make existing things out of fire by condensation and rarefaction, and resolve them again into fire, regarding it as the one underlying substance; for Heraclitus says that everything is an exchange for fire.⁷²

Why must fire be finite? In the text at hand Simplicius (recounting Theo-

⁷¹ See Cornford, *ibid.*, p. 147, n. 1; P. J. Bicknell, p. 40.

⁷² Also see Aristotle, *Physics*, 205a1-4; Diogenes Laertius, IX, 8. On the Pythagorean Hippasus, see G, vol. II, 320-22; J. A. Philip, pp. 26-30.

phrastus) gives no hint of Heraclitus' own reasons. In G. Vlastos' view, though, one can reconstruct them from his anti-Milesian concept of the relation of the world-creating *arche* to its creatures.

For Anaximander the creative source of the world is wholly outside of it; for Anaximenes it is both in and beyond the world; for Heraclitus it is wholly within the world, which is itself the theatre of the ceaseless and regular transformations of fire, therefore, self-creating, self-governing, self-contained . . . [Accordingly] if the two [i.e., the world-creating *arche* and its creatures] are one, as in Heraclitus, then the *arche* neither need, nor can, be infinite. It need not, for no matter how limited may be its mass, its energy, ever-renewed by reabsorbing its own creatures, is inexhaustible, and thus sufficient to maintain it for all time to come. It can not, for it is interdependent with its creatures, and can be no more infinite than they: if it were, the balance of their mutual "exchanges" would be completely upset.⁷³

Vlastos' contrasting Heraclitus with Anaximander and Anaximenes brings up another relevant inquiry: is Heraclitus still within the common world-picture we mentioned at the beginning of this section? Vlastos would answer affirmatively. Even though Heraclitus' fire (or, to use another term for the same, *logos*) is finite, even though it does not transcend the world, still he does consider it truly an *arche*, sustaining, undergirding, nourishing global harmony-in-strife. Moreover, despite differences between the three, "the main historical influences on Heraclitus' thought were the great Milesians, Anaximander and Anaximenes, and . . . our best chance to understand the problems which confronted him and the meaning of his own answers to them is to discover as best we can the links which connect his thought with theirs."⁷⁴

Guthrie also gives an affirmative answer, but for different motives. "If we suppose that Heraclitus had not emancipated himself from this general conception which was common to the philosophical and popular religious thought of his time, it is a little easier to make sense of his cosmology and the part played in it by the Logos-fire." How so? This conception allows fire to be found both within and without the cosmos.

In fr. 30, the ever-living fire that is "kindled in measures and extinguished in measures" (i.e., involved in warfare and the "way up and down") is with some emphasis identified with "this world-order of ours" . . . which suggests the possibility that there exists something else not so designated. This will be the Logos-fire (or *aither*) surrounding the cosmos in its purity, inextinguishable and

⁷³ "On Heraclitus," *AJP*, 76 (1955), 366; M. de Corte considers fire to be *peperasmēnon* because it is "encerclé" by Logos, which is "l'Encerclant" ("La vision philosophique d'Héraclite," *LThPh*, 16 [1960], 214). See C. H. Kahn, "A New Look at Heraclitus," *APQ*, 1 (1964), 202-203.

⁷⁴ "On Heraclitus," p. 354. On pp. 355-65 he substantiates that influence.

invisible, mind and soul in their highest form (though not yet conceived as wholly incorporeal). Like the *arche* of other thinkers it "steers all things" (fr. 64). It determines the "measures" which limit the extent of the "ups and downs" within the cosmos and ensure the persistence of the inconclusive battle between its constituent parts, the guarantee of its continued life (G, vol. I, 471).⁷⁵

In conceiving the transcendent Logos-fire as the everlastingly alive *arche* which surrounds and steers the cosmos, Heraclitus remains under the influence of the world-view of his Ionian predecessors.⁷⁶

Kirk denies that influence. Heraclitus' universe is perpetual and, thus, neither needs nor has an *arche*. While commenting on Fragment 30, "This world-order . . . did none of the gods or men make, but it always was and is and shall be: an ever-living fire," Kirk states:

The world-order as a whole can be described as a fire of which measures are being extinguished, corresponding measures being re-kindled . . . It always has been, and always will be, in this condition. Cosmogony in the Milesian sense is therefore not to be found in Heraclitus. Fire cannot be an originative stuff in the way that water or air was for Thales or Anaximenes, and according to Aristotle and his followers it is no longer indefinite or infinite . . . Regarded as a *part* of the cosmos, fire is on a par with sea . . . and earth, as one of the three obvious world-masses (KR 200).

But if fire is not an *arche* and is on a par with water and earth, why does it have a pre-eminent place and function? Kirk tries to solve that problem by identifying primal fire with *aither*.

The fire in question (in B30) is not simply that which burns in the hearth, because this has no claim to be more important or more primary than sea or earth. The cosmological fire must be thought of primarily as *aither*, that purer kind which in popular thought fills the upper region of the heavens and is considered to be divine and immortal.⁷⁷

⁷⁵ On *aither* as viewed by Kirk and Vlastos, see below, n. 77. Guthrie does not stress the finiteness of Heraclitus' *arche*. In fact, he suggests that Theophrastus (as reported by Simplicius, *In Phys.*, 23. 33 sq.) may have incorrectly represented it as *peperasmēnon*. But even "if it is true that Heraclitus denied the infinity of fire, it would not necessarily follow that he limited it to this cosmos" (vol. I, 469, n. 1).

⁷⁶ Guthrie does not intend to deny the differences between Heraclitus and preceding thinkers or to undercut his originality, as other statements show. Heraclitus uses "a prophetic rather than a dialectical mode of expression" (vol. I, 413-414). As an inspired writer, he does not "have the rationalistic outlook of the Milesians" (p. 415). "No attempt to link Heraclitus directly and positively with his predecessors has much chance of success. In all probability he was a far more isolated thinker than such attempts presuppose" (p. 416). He reacted against the Ionian and, especially, the Pythagorean schools of thought (pp. 416-17). "The thoughts in his mind were ahead of his time and language" (p. 486). See J. Kerschensteiner, p. 114.

⁷⁷ *Heraclitus: The Cosmic Fragments* (Cambridge: University Press, 1954), p. 316. Vlastos ("On Heraclitus," p. 362) refuses that solution because no one knows

Conclusion

Whether or not Heraclitus fits within the world-view which Anaximander, Anaximenes and others in the sixth and fifth centuries share is problematical, then. What is indisputable, though, is the gradual dimming of infinity in their theories. In Anaximander it shone brilliantly, since his primal agent and source *was* the Infinite. Its rays were curtailed when Anaximenes settled on air as *arche* and *apeiron* became subsidiary. It burned still more feebly when Xenophanes used it merely to describe the location of the earth, the length of the sun's westward journey and the number of suns and moons. Finally, it was extinguished when Heraclitus affirmed fire-logos to be *peperasmēnon*.

This gradual snuffing out of infinity, we might add, was matched by a noticeable flare up in monistic tendencies. Things in Anaximenes' cosmos were in closer touch with their *arche* than those in Anaximander's were with *to apeiron*. Xenophanes' universe apparently was downright pantheistic. Although Heraclitus' location of harmony-in-opposition and stability-in-dynamism at the heart of reality was a brilliant and original move, still his position was a panlogism, a panpyrism.

If the light of infinity died out among the Ionian philosophers, it would be rekindled in the Italian School, to which we now turn.

whether popular thought made a distinction between our fires and celestial fire and because celestial fire "is not to be found in Heraclitus nor in any pre-Socratic fragment, and . . . no Ionian philosopher thought of 'cosmological' fire, air, etc. as different in kind from that we see and handle every day. The first surviving text in which this peculiar notion is asserted is in Plato." For a vindication of hearth-fire against Kirk, also see B. Helm. "Social Roots of the Heraclitean Metaphysics," *JHI*, 25 (1964), 565-71. (For a study of other reactions to Kirk's important book, just mentioned, see Kerferd, pp. 135-36.) On *aither*, see Franz Lämmli, *Vom Chaos Zum Kosmos*, Heft 10 of *Schweizerische Beiträge zur Altertumswissenschaft* (Basel: Verlag Friedrich Reinhardt, 1962), pp. 98-101.

For another view of Heraclitus, see F. M. Cleve (pp. 33-39, 114-15), who follows Adolf Stöhr in finding a serious impact on Heraclitus of the Persian religious figure, Zarathustra or Zoroaster. Moreover, Heraclitus is not a natural philosopher, as were the Ionians. His *pyr aeizoon* is not "everlasting fire" but "everliving ether," which "can be imagined as a finest condition of matter (- something like ether in modern systems -), with a medium temperature, neither cold nor burning hot, a life-warm finest substance" (p. 40). He and Xenophanes have essential features of doctrine in common (p. 116). On Heraclitus and Zoroaster, see R. M. Afnan, *Zoroaster's Influence on Greek Thought* (New York: Philosophical Library, Inc., 1965), pp. 75-88.

On Heraclitus, also see J. Owens, *History*, pp. 44-54; J. Burnet, *EGP*, pp. 147-51, 161; Mondolfo, pp. 77-82; O. Gigon, *Untersuchungen zu Heraklit* (Leipzig: Dietrich, 1935); *idem*, *Der Ursprung der Griechischen Philosophie* (Basel: Benno Schwabe & Co., 1945), pp. 197-243; J. Kerschensteiner, pp. 97-114; D. Mayor, "Heráclito: 'Ekpyrosis'?" *Pensamiento*, 16 (1960), 69-80.

CHAPTER III

PYTHAGORAS

If one had to summarize modern scholarship on the Pythagoreans who headed the Italian school of philosophy, he could use the single word "controversies." In the opinion of Guthrie, "the history of Pythagoreanism is perhaps the most controversial subject in all Greek philosophy," even though research on them is so extensive as to be a "bottomless pit" (vol. I, p. 146 and n. 1). At one extreme some scholars favor almost complete scepticism. Either there was no historical Pythagoras or, if he was more than fiction, he was no mathematician or philosopher but a wonder worker, a Greek shaman, who was credited by devotees and by subsequent writers (e.g., Porphyry, Iamblichus) with Platonic, Neopythagorean and Neoplatonic doctrines. At the other extreme are those authors whose view is dictated by great credulity. Not only was Pythagoras a historical figure of great religious and political influence. He also initiated great advances in philosophy and mathematics. Practically everything attributed to him by Herodotus, Plato, Isocrates, Heraclides of Pontus, Aristotle, Aristoxenus, Dicaearchus, Porphyry, Iamblichus is his authentic doctrine.⁷⁸

In recent years the pendulum has swung more to the middle. After

⁷⁸ For surveys of modern attitudes, see P. Kucharski, "Les principes des Pythagoriciens et la dyade de Platon," *ArchPhil*, 22 (1959), 175-91 and 385-431; Karl-Heinz Ilting, "Zur Philosophie der Pythagoreer," *Archiv für Begriffsgeschichte*, 9 (1964), 103-108 (Ilting recommends following Plato as guide to authentic Pythagorean doctrines: pp. 108-131); Walter Burkert, *Weisheit und Wissenschaft: Studien zu Pythagoras, Philolaos und Platon* (Nürnberg: Verlag Hans Carl, 1962), pp. 2-12; C. J. DeVogel, *Pythagoras and Early Pythagoreanism: An Interpretation of Neglected Evidence on the Philosopher Pythagoras* (Assen: Van Gorcum and Company, 1966), pp. 8-19, 28-30 (*re* Holger Thesleff), 245-46 (*re* A. Rohde's and Walter Burkert's contention that Pythagoras was no philosopher or mathematician but a Greek shaman). A great deal of detailed information on modern interpretations is given by Holger Thesleff in his study of pseudonymous Pythagorean texts: *An Introduction to the Pythagorean Writings of the Hellenistic Period* (Abo: Abo Akademi, 1961), pp. 30-71.

surveying the literature within the period from 1953 to 1962, Kerferd concluded:

Everything depends upon the assessment of the sources. There are some signs that a period of extreme scepticism concerning the possibility of knowledge about, or even the existence of, important Pythagorean doctrines in the fifth century may be passing, but no generally agreed picture is yet in sight. However, the existence of a developed Pythagorean cosmology in the fifth century is beginning to seem more likely than it once did, and there is a growing readiness to make at least cautious use of the fragments of Philolaus in this connection. There is also perhaps a better understanding of the way in which religious mysticism and fantasy could combine with a rationally elaborated cosmology, whether in the thought of Pythagoras himself, or of his successors (p. 134).

Granted, then, that a more moderate appraisal of Pythagoras is gaining ground, but, as Kerferd says, "no generally accepted picture is yet in sight" among these moderates. This will be clear if we outline two recent interpretations of Pythagoras' doctrine on limit/infinity: one by J. E. Raven, the other by J. A. Philip. This outline will also enable us to work out our own tentative position.

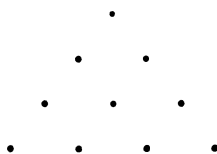
J. E. Raven

Raven presents his version of Pythagoreanism mainly in two books. *Pythagoreans and Eleatics: An Account of the Interaction Between the Two Opposed Schools during the Fifth and Early Fourth Centuries B.C.* (Cambridge: University Press, 1948) is the published version of his doctoral dissertation under the direction of F. M. Cornford. Intended as a commentary (although often a dissenting one) upon Cornford's interpretation, this book studies the Pythagorean system in its Pre- and Post-Parmenidean forms (*ibid.*, p. 6). Raven's second book is *The Presocratic Philosophers* (Cambridge: University Press, [4th printing] 1963), which he wrote in collaboration with G. S. Kirk, to which we frequently have referred as KR and in which he can be expected to have taken into account criticisms by reviewers of his earlier treatise. Raven continues the same approach here as in *Pythagoreans and Eleatics*: "The most that we can hope to achieve is to divide the Pythagoreanism of the fifth century into two main periods, one before Parmenides, the other after Zeno; ... the primary means by which even so much may be achieved consists in considering which Pythagorean doctrines seem to be attacked by Parmenides and which look like a reply to either Parmenides or Zeno" (KR 236).

Let us now trace as simply and yet accurately as possible Raven's views.⁷⁹

Deep differences separate the Pythagoreans from the Milesians. The latter were impelled by "innate intellectual curiosity and dissatisfaction with the old mythological accounts to attempt a rational explanation of physical phenomena," whereas "the impulse underlying Pythagoreanism seems to have been a religious or emotional one." Also, the Milesians sought "a purely naturalistic explanation of the world," while the Pythagoreans were concerned "more with the form or structure of the world than with its mere matter" (KR 216). Despite these dissimilarities, though, Pythagoras (ca. 570-ca. 480) and his followers did work out a cosmogony in which *to apeiron* plays an important part.⁸⁰ Let us consider their position before and, then, after Parmenides and Zeno had criticized it.

A Pythagorean philosopher views all things as somehow involving numbers: they either imitate or, even, are numbers. What does this involvement mean? Having no simple form of numerical notation, the early Pythagoreans used patterns of dots or alphas to express numbers – for instance, the number 10 was represented by ten dots arranged in an equilateral triangle (KR 230, n. 2).⁸¹



⁷⁹ We shall hereafter refer to Raven's first book as *PE*. On occasion we shall supplement Raven's explanations by references to other scholars – especially Guthrie, vol. I, 146-340, who rather generally agrees with *PE* and KR.

⁸⁰ What information do we have on Pythagoras himself? We know "that Pythagoras was in fact a historical, not merely a legendary, figure. The difficulty lies in establishing anything more than his bare existence; but we shall find that on the basis of what little contemporary or early evidence survives it is possible to reconstruct at least the rough outlines of his system" (KR 219). The technique of the reconstruction is to attribute "to Pythagoras himself such of the later Pythagorean doctrines as could without anachronism have been held in the sixth century B.C. and may plausibly account for the subsequent spread and development of Pythagoreanism" (KR 228). See G, vol. I, 166-69, 181; vol. II, 348, where Guthrie suggests that Pythagoras may have died ca. 500-490 (see also p. 349, n. 1).

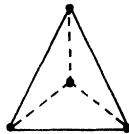
⁸¹ Ten or decad is the perfect number ($1 + 2 + 3 + 4 = 10$) and is represented by the triangle called a "tetractys" (from the Greek word meaning "in four parts or ways"). See KR 243 for similarly constructed diagrams of a square and a rectangle. Also see Raven, *PE*, 51-54, 120; G, vol. I, 224-26. In their approach to numbers, the Pythagoreans accomplished what Dan Bădărașu calls a *matérialisation du nombre* ("Le nombre chez les premiers Pythagoriciens," *Analele Univ. dei București*, 5 [1962], 92). H. Cherniss, *ACPP*, p. 392, considers their two statements, "Things are numbers" and "Things imitate numbers," to be contradictory. For an

The result of representing numbers by such diagrams was that these philosophers thought of numbers as spatially extended and came to confuse the arithmetical unit with the geometrical point and, finally, with the primitive atoms which constitute physical matter. This confusion had two consequences. "All things are numbers" is equivalent to saying, "All things are literally composed of units-points-atoms" (KR 245-50).⁸² Secondly, the generation of numbers is at once the generation of geometrical figures and of physical bodies. The origin of mathematical items is also a cosmogony. To illustrate briefly from information furnished by Speusippus:

Text I: Speusippus apud *Theologumena Arithmeticae*, p. 84, 10 (DK 44A13; KR 253-54):

For 1 is the point, 2 the line, 3 the triangle and 4 the pyramid. All these are primary, the first principles of individual things of the same class... and the same holds in generation too; for the first principle in magnitude is the point, the second the line, the third surface and the fourth the solid.

That is to say, the point corresponds to 1, line to 2, triangle to 3, pyramid to 4 – this last for manifest reasons:



Hence, just as 2, 3 and 4 issue from 1, so too do line, triangle and pyramid.⁸³ But the four points in a pyramid are equivalent to four physical atoms, with the consequence that a pyramid is equivalent to a material body. Accordingly, physical things arise also from the number 1 (KR 253-56).⁸⁴

interpretation of Pythagorean mathematical theories as recounted by Aristotle, see T. G. Sinnige, pp. 68-83. Also G. Kröber, pp. 91-104.

⁸² Also see Raven, *PE*, p. 62 sq.; G, vol. I, 229-38.

⁸³ See KR 254-56; Raven, *PE*, 105-111; G, vol. I, 256-62. Both Raven (*ibid.*) and Guthrie (pp. 262-65, with a fine diagram on p. 264) mention a "fluxion theory," according to which "the first unit 'flowed' into a line, the line into plane and the plane into a solid. By this method, however, ... the resulting figures are obviously not ... the triangle and the tetrahedron, but rather the square and the cube" (KR 254). Both scholars agree this theory belongs not to early but to late Pythagoreans.

⁸⁴ Also see Raven, *PE*, 149-59, especially p. 158: "Numbers are the ruling factor in cosmogony. We have watched the growth of the point, which equals the number 1, first into the line or 2, next into the plane or 3, and finally into the solid or 4. The pyramid, the consummation of that process, is the starting-point of the next.

Obviously, the question now is: Whence the number 1? A reply necessitates discussing Limit-Unlimited, and this can best be done by turning to several key-texts in Aristotle.

Text II: Aristotle, *Metaphysics*, 985b23 sq. (KR 236-37):

Contemporaneously with these philosophers [Leucippus and Democritus] and before them, the Pythagoreans, as they are called, devoted themselves to mathematics; they were the first to advance this study, and having been brought up in it they thought its principles were the principles of all things. Since the first of these principles by nature are numbers, and in numbers they seemed to see many resemblances to the things that exist and come into being – more than in fire and earth and water (such and such a modification of numbers being justice, another being soul and reason, another being opportunity – and similarly almost all other things being numerically expressible); since, again, they saw that the attributes and the ratios of musical scales were expressible in numbers, and numbers seemed to be the first things in the whole of nature, they supposed the elements of numbers to be the elements of all things, and the whole heaven to be a musical scale and a number . . .

Text III: *ibid.*, 986a15 sq. (KR 237-38):

Evidently, then, these thinkers consider that number is the principle both as matter for things and as their modifications and permanent states, and hold that the elements of number are the even and the odd, and of these the former is unlimited, and the latter limited (*to men apeiron, to de peperasmenon*) . . .⁸⁵

Text IV: *ibid.*, 986a22 (KR 238):

Other members of this same school say there are ten principles, which they arrange in two columns of cognates – limit and unlimited (*peras kai apeiron*), odd and even, one and plurality, right and left, male and female, resting and moving, straight and curved, light and darkness, good and bad, square and oblong. In this way Alcmaeon of Croton seems also to have conceived the matter, and either he got this view from them or they got it from him; . . . for he expressed himself similarly to them.⁸⁶

Text V: Aristotle, *Metaphysics*, 1091a12 sq. (KR 250):

It is strange also to attribute generation to eternal things, or rather this is one of the things that are impossible. There need be no doubt whether the

We have seen how the pyramid is equated with fire, the cube with earth, the octahedron with air, and the icosahedron with water, and how each of these figures stands, by virtue of its equation with a number, in a definite relation to the other three. Again the consummation of this process is somehow the origin of the next. These elements are next mingled one with another in determinate proportions to generate the natural objects, . . . that our senses perceive." On p. 157 Raven makes clear that this cosmological conception is the property not only of late but of early Pythagoreans as well. Also see below, n. 95, n. 112. On line, plane and solid as parallels to 2, 3 and 4 in Plato's unwritten doctrines, see I. M. Crombie, *An Examination of Plato's Doctrines* (London: Routledge and Kegan Paul, 1963), II, 426-65; T. G. Sinnige, pp. 173, 194-96.

⁸⁵ The omitted sentence, indicated here by the four dots, is judged to express a doctrine of post-Parmenidean Pythagoreans (KR 317). It will be studied *infra* as text IX.

⁸⁶ On Alcmaeon, see KR 232-35; G, Vol. I, 341-59. He seems to have been a

Pythagoreans attribute generation to them or not; for they obviously say that when the one had been constructed, whether out of planes or of surface or of seed or of elements which they cannot express, immediately the near part of the unlimited began to be drawn in and limited by the limit (τὸ ἔγγιστα τοῦ ἀπείρου . . . ἐπεραίνεται ὑπὸ τοῦ πέρατος).

Text VI: Aristotle, *Physics*, 213b22 sq. (KR 252):

The Pythagoreans too held that void exists and that breath and void enter from the unlimited (*ek tou apeiron*) into the heaven itself, which, as it were, inhales; the void distinguishes the natures of things, being a kind of separating and distinguishing factor between terms in series. This happens primarily in the case of numbers; for the void distinguishes their nature.

In text II Aristotle aims at disclosing the factors which led the Pythagoreans to conclude that all things imitate or are numbers: their dedication to mathematical studies, the resemblance between numbers and actual things (as instances Aristotle lists justice, soul, reason, opportunity and “almost all other things”), the ability of musical scales to be translated into numerical ratios.⁸⁷ In III he shows that number is not itself ultimate but yields to a prior dualism of Limit/Unlimited. Numbers are odd and even; but odd/even are themselves specifications of Limit/Unlimited – they are *peras/apeiron* as found on the mathematical level; therefore, numbers are grounded in Limit-Unlimited.⁸⁸ They are Limit/Unlimited as manifesting or deploying themselves on the arithmetical, geometrical and finally (since concrete things *are* numbers) physical levels. In fact, text IV may be interpreted as restating the primacy of *peras/apeiron*. None of the subsequent pairs in the Columns of Opposites is intended to be radically distinct from them: odd and even, one and plurality, right and left, male and female, and so on *are* Limit/Unlimited as manifested in more precise fields.⁸⁹ All factors on any level of reality can be reduced to two ultimate constituents: *peras* and *apeiron*.

rather independent thinker and not a Pythagorean, although he was probably born before Pythagoras had died. Even if Alcmaeon may have first conceived a Table of Opposites, the early Pythagoreans were certainly aware of and used such a Table too. See KR 241; Raven, *PE*, 44; G, vol. I, 232, 246-47; Burkert, *Weisheit*, 45-46; M. L. West, “Alcmaeon and Pythagoras,” *CQ*, n.s. 17 (1967), 1-15. On the Table of Opposites, see G. E. R. Lloyd, “Right and Left in Greek Philosophy,” *JHS*, 82 (1962), esp. 59-66.

⁸⁷ KR 229-31, 243-50. G, vol. I, 220-26 is skeptical about Pythagoras’ and his early followers’ awareness of the correspondence between musical scales and numerical ratios (vs. not only Raven but Burnet, Taylor, Cornford and others, who do not “give authority for their categorical statements”; p. 221). The earliest attribution of the musical discovery to Pythagoras is by Porphyry (p. 222). Aristoxenus’ statement that “Pythagoras derived his enthusiasm for the study of number from its practical applications in commerce. . . . is by no means an improbable supposition” (p. 221).

⁸⁸ KR 239-45; Raven, *PE*, 126-31; G, vol. I, 240-46.

⁸⁹ KR 241; Raven, *PE*, 49 sq.; G, vol. I, 246-53.

Texts V and VI provide some information on the genesis of the number 1. Aristotle once complained (*Meta.*, 1080b20; KR 251) that the Pythagoreans "seem at a loss to describe how the first unit with magnitude (*to prōton hen . . . echon megethos*) was constituted." However that may be, enough data is at hand for a somewhat plausible account. According to V and VI the stages of Pythagorean cosmogony apparently are these: (1) the construction of the unit out of the seed; (2) its effect upon the Unlimited; (3) its development, step by step, into the sensible universe. Let us briefly take up each stage.

Stage one: The unit arises from a seed rather than from a plane or surface (text V) since these last two follow upon the unit. But why a seed? Possibly it is an echo of the pre-philosophical genealogies of mythology.⁹⁰ As Cornford noted, "This biological conception fits the notion of the world as a living and breathing creature, which, like other living things, would grow from a seed to its full form. It also fits in with the position of the male principle under Limit, the female under Unlimited, in the Table of Opposites."⁹¹ Most likely, the seed, as well as the unit which results from it, is the Limit itself about to draw in and limit the *Apeiron* nearest it (text V).⁹²

Stage two explicates the initial function of the Unlimited in the process. Immediately after the origin of the unit, the nearest part of *to apeiron* is drawn into and limited by *to peras* (text VI). Within the biological context possibly adopted by the Pythagoreans, the *apeiron* would be like a placenta in which the seed-unit-limit is implanted, is nourished and grows.⁹³

⁹⁰ KR 251-53; Raven, *PE*, 46-48; Burkert, *Weisheit*, pp. 34-35. For T. G. Sinnige (pp. 55-58) Pythagoreanism duplicates Orphism, which in turn is a channel for Phoenician and Babylonian mythology.

⁹¹ *PP*, p. 19. Also see G, vol. I, 278-81, where the seed is identified with fire: "The growth of the cosmos proceeded from the centre outwards. We also find, as we go on from cosmogony to cosmology . . . that for the Pythagoreans the centre was occupied by fire. The unit-seed, then, physically considered, was of the nature of fire, and we can see what lay behind the brief doxographic statement in Aëtius that 'Pythagoras derived the world from fire and the fifth element.' The active or formative element was the fiery unit; the living material on which it fed [and which is the *apeiron*] was identified by the Pythagoreans with air or breath, but was in fact that substance embracing or cradling the world (*to periechon*) in which most of the Presocratics believed, and which later cosmologists distinguished as a separate fifth element." Both Guthrie (pp. 278-79) and Raven (KR 312-13) analyze an interesting and informative text from Philolaus on animal birth.

⁹² On the early Pythagorean identification of unit with limit, see Raven, *PE*, 115-25; G, vol. I, 246-47. On pp. 119-20 Raven points out difficulties which this identification entailed.

⁹³ Guthrie explains in some detail the identification between the *apeiron*, which the seed-unit draws in and limits, and time (vol. I, 336-40). That section is a comment on Stobaeus, *Anth.*, I, 18, 1c (KR 252): "In the first book of his work

Stage three describes the subsequent process of growth. The unit begins to inhale the Unlimited in which it is implanted,⁹⁴ with the result that it begins at once to grow and, as the effect of its growth, to burst asunder into two (= the number 2, as well as its geometrical correspondent [line] and its physical counterpart). Simultaneously the void steps in from the *apeiron* (according to text VI) and keeps the two units apart. Three follows upon two, and four upon three until, owing to the identification of arithmetical units with geometrical points and physical atoms, the arithmetical, geometrical and sensible worlds have been fashioned and formed.⁹⁵

Such, then, is a somewhat likely account of how Pythagoreans prior to Parmenides conceived *to apeiron*. Together with *to peras*, it is a factor both in the genesis and make-up of arithmetical series, geometrical figures and physical bodies (because, basically, they viewed numbers as spatially extended). It is, so to speak, the placenta which receives and nurtures the seed-limit. It is the material aspect, the indeterminate but determinable dimension of reality, which is matched and complemented by *to peras*, the formal, structurizing determinant.

In this interpretation the Pythagoreans have substituted a dualism for the monism of Anaximander and Anaximenes in a rather fascinating way. These latter thought the originative stuff of the universe to be a single kind of material, the very nature of which was linked with infinity (for Anaximander that material was identical with *to apeiron*, for Anaximenes it was air infinite in extent). Pythagoras and his followers retained *to apeiron* as the material factor within the universe, but added a "formal," determinative counterpart, called *to peras*.⁹⁶ This addition shows them to be groping,

On the Philosophy of Pythagoras he [Aristotle] writes that the universe is one, and that from the unlimited there are drawn into it time, breath and the void, which constantly distinguishes the places of the various classes of things." See especially Guthrie's résumé on p. 340: "In saying that 'the nearest portions of the Unlimited were drawn in and limited by the limit' the Pythagoreans were describing what to us might seem three unrelated processes, though to them they were only three aspects of a single process: the Limit, that is the growing cosmos, breathed in matter for its physical growth. it imposed form on sheer extension, and by developing the heavenly bodies to swing in regular, repetitive circular motion around their harmoniously related orbits it took in the raw material of time and turned it into time itself."

⁹⁴ This doctrine of inhalation, according to Guthrie, makes the Pythagoreans similar to the Milesians (vol. I, 200-201; pp. 271-72; p. 278). Also see Kahn, p. 97; T. G. Sinnige, pp. 59-60. But see P. J. Bicknell, pp. 47-48.

⁹⁵ KR 250-56; Raven, *PE*. 50-51, 130-45, especially the summary on pp. 139-40. Also see above, n. 84.

On the qualitative differences that distinguish the various objects of sense from one another, see *PE*, pp. 62-64, especially the summary on p. 64.

⁹⁶ *PE*, pp. 18, 176; Guthrie, vol. I, 237-38, 249-51. Both are in opposition to

however unaware they themselves might be of that fact, towards conceiving truly immaterial realities, although "they end in a corporealism hardly less total . . . than that of the Milesians" by their agreement (as Aristotle noted) "with the other physicists that being is just so much as is sensible."⁹⁷

If we briefly turn to post-Parmenidean Pythagoreans, we find them (in Raven's version) putting forth one doctrine at least which is quite different from that of their predecessors. It concerns the nature and origin of the unit.

Text VII: Theo Smyrnaeus, p. 21, 20 (KR 317-18):

The first division of numbers that they [the Pythagoreans] make is into two classes, calling some even, some odd. Even numbers are those which can be divided into equal parts (e.g., 2 or 4), odd those which can be divided only into unequal parts (e.g., 5 or 7). Some held that the first of the odd numbers is 1. For even is the contrary of odd; 1 is either odd or even; it cannot be even; for so far from being divisible into equal parts, it cannot be divided at all; whence it follows that 1 is odd. Again, if you add even to even, the whole is even; but add 1 to an even number and it makes the whole odd; whence it follows that 1 is not even but odd.

Text VIII: Theo Smyrnaeus, p. 22, 5 (DK 47A21; KR 318):

Aristotle, however, in his work on the Pythagoreans says that 1 partakes of the nature of both; for when added to an even number it makes it odd, when added to an odd, even – which would be impossible if it did not partake of the nature of both; and so, he says, it is called even-odd.

Text IX: Aristotle, *Metaphysics*, 986a15 sq. (KR 309):

These thinkers consider that number is the principle both as matter for things and as their modifications and permanent states, and hold that the elements of number are the even and the odd, and of these the former is unlimited, and the latter limited. And the 1 proceeds from both of these (for it is both even and odd), and number from the 1; and the whole heaven, as has been said, is numbers.

In text VII Smyrnaeus appears to present the position of pre-Parmenidean Pythagoreans. The number 1 is odd because 1 cannot be divided into parts, as can even numbers; secondly, because 1 added to an even number makes it odd. In the light of texts III to VI, analyzed above, this entails that 1 is limit because odd is equated with limit: 1 is *peras* as implanted in the *apeiron*, as drawing this latter in and limiting it, as developing into 2 and subsequent numbers, as inhaling the void which

Cornford, who interprets Pythagoreanism as a monism. Behind all else there is an ultimate One, from which were derived Limit and the *apeiron* and, through them, the unit which is the first number, point and physical atom. See F. M. Cornford, "Mysticism and Science in the Pythagorean Tradition," *CQ*, 16 (1922), 137-50 and 17 (1923), 1-12; *PP*, pp. 1-7.

⁹⁷ KR 216. The Aristotle text referred to is *Metaphysics*, 989b31.

enters the heaven from the *apeiron* and which separates the numbers from each other.

But in texts VIII and IX our sources present the doctrine seemingly of Pythagoreans who had felt the sting of Parmenides' criticism. Plurality cannot come from absolute unity, the Eleatic thinker argued. If, then, the initial unit were odd or limit solely, it would not be the source of plurality. To be an *arche*, it must be a composite of odd-even, of limit-unlimited.⁹⁸

Such, actually, seems to be the objection triggering texts VIII and IX, which grant a concession so as to withstand the attacks. One is neither odd nor even: it is both at once. It is odd-even because if added to an even number, 1 makes it odd; if added to an odd number, 1 makes it even. Hence, it shares in both oddness and evenness. In the wake again of texts III to VI, this means that one is itself no longer limit only but is limit-unlimited. It proceeds from both, it is a blend of both (text IX) and, accordingly, can itself be the source of subsequent plurality.

But this concession demands in turn that adjustments be made in the cosmogony charted by post-Parmenidean Pythagoreans. No longer can one-limit be implanted in the unlimited, draw it in, and so on, since the one is itself a combination of limit-unlimited to begin with.⁹⁹ By that simple but significant change in the structure of the 1, "another of the Eleatic criticisms, that directed against the 'inhalation' of the one principle by the other, is duly acknowledged and countered" (KR 318).

What our survey of Raven's position makes clear is that "from early in the fifth century, when first, apparently, it enters Aristotle's ken, down to the time when it merges with, and is lost in, the deeper, stronger current of Platonism" (PE, p. 176). Pythagoreanism evolved through two stages.

In the original pre-Parmenidean system we find the principle of Unity or Limit progressively inhaling and limiting the opposed principle to generate the plurality of extended unit-points which, separated by the void, compose the physical bodies of the universe. But the criticisms of Parmenides involved the abandonment of the equation of Limit with Unity, while Zeno's attack necessitated the admission that unit-points could not after all have any magnitude. We find, then, by the end of the century that a system has been elaborated which, like other systems of the period, has taken full account of the consequences of the Eleatic logic... but which yet has retained all the fundamentals of the earlier Pythagoreanism (p. 163).

By way of contrast, how does J. A. Philip interpret Pythagoreanism?

⁹⁸ Raven, PE, 121-25.

⁹⁹ On the cosmogony outlined by the post-Parmenidean Pythagoreans, see Raven, PE, 152-58, 178-79.

J. A. Philip

Philip does not intend his book, *Pythagoras and Early Pythagoreanism* (Toronto: University of Toronto Press, 1966) to be a polemic against Raven, with whom actually he agrees on occasion.¹⁰⁰ Rather he aims at "surveying all the evidence up to and including Aristotle, using Aristotle as a principal basis for reconstruction" (p. V) concerning the "Pythagoreanism of the fifth century down to the time of Archytas," a contemporary of Plato (p. 7). He is mainly interested, therefore, in discovering the authentic doctrines of Pythagoras and his early followers.

Nonetheless, Philip does disagree with Raven on several points. For Raven (see above, notes 85, 88, 89) all ten pairs in the Table of Opposites pertain to the initial era of Pythagoreanism and constitute a structured whole. But for Philip early Pythagoreans are responsible only for the primary pairs (limit/unlimited and odd/even); the rest belong to the last half of the fifth century. Moreover, the "list itself exhibits no logical sequence nor structure . . . The table would appear to have been padded out

¹⁰⁰ Some areas of agreement are relatively of little importance: refusal of Cornford's conception of the One as prior to Limit/Unlimited and as their source (for Raven, see above, n. 96; Philip, p. 37, n. 8); dating the "fluxion" theory of derivation of numbers as late (Raven, *supra*, n. 83; Philip, p. 98, n. 6 and p. 102, 4th prgr.). Other areas are of greater significance. For instance, Parmenides' doctrine is a reaction to Pythagoreanism (KR 274, 277; Philip, pp. 35-36; pp. 44-45; p. 56, n. 7; pp. 89-90, where he mentions KR 272-77; p. 94). Again: Post-Parmenidean Pythagoreans are reacting to Parmenides and Zeno (see "Raven" section above, *passim*; Philip, p. 84; p. 107, 1st prgr.), although Philip also concludes that Raven's reconstruction (PE, 101-111) of Philolaus' theories as a reply to Zeno is unconvincing (p. 42, n. 12), that Zeno may be defending Parmenides against all pluralist systems and not specifically against Pythagorean pluralism (p. 88), that there are no grounds for saying there was a Pythagorean reaction to Zeno's argument or of what nature it was (p. 89), that Aristotle, *Metaphysics*, 1001b7 does not indicate Zeno to be arguing against Pythagorean "atomists" (p. 104, n. 13).

Still another important agreement is that the one as odd/even rather than simply odd is a late Pythagorean conception (for Raven, see above, p. 82 sq.; Philip, p. 99, n. 7). Philip is not completely consistent, though. When speaking presumably of early Pythagoreans, he describes the one as the product of *peras/apeiron*, which indicates it to be not odd solely but odd/even. See pp. 61, 67, 90, 92. On p. 68 he explicitly states that "the first *peperasmemon*, the One, which is 'even-odd', is a product of both pairs." But on the same page ("operation of Limit as One on the Unlimited as void") he seems to view one as limit, a capital mark of early Pythagoreanism for Raven.

Philip gives more information on his position in the following: "Aristotle's Monograph *On the Pythagoreans*," *TAPA*, 94 (1963), 185-98; "Aristotle's Sources for Pythagorean Doctrine," *Phoenix*, 17 (1963), 251-65; "Pythagorean Theory of Derivation of Magnitudes," *ibid.*, 20 (1966), 32-50.

to the perfect number of the *tetractys*." The opposites were all interpreted in the Pythagoreanism of the fourth century as either "good" or "bad," undoubtedly, but it is improbable that the original pairs were so qualified.¹⁰¹ The presence of good/evil in the Table does not imply a "dualism in the cosmos, but rather a classification of goods to be pursued and evils to be shunned."¹⁰²

Another major disagreement concerns the place of mathematics in initial Pythagoreanism. According to Raven the first Pythagoreans were conversant with technical mathematics. They proposed that physical things were derived from mathematics because arithmeticals (numbers) produce geometricals (point, line, surface, solid), which in turn produce or are sensible existents (see *supra*, "Raven" section, *passim* and notes 84, 95). In Philip's view, though, early Pythagorean thought was not phrased in geometrical terms (p. 11; p. 73, n. 8; p. 102, 3rd. prgr.; p. 106). In fact, there was no science of geometry as such until the end of the fifth century (p. 30). Even someone as comparatively late as Philolaus (ca. 470-after 399) was not strictly a mathematician (p. 33; p. 41, n. 10). No grounds can be found for thinking "that any Pythagorean or Pythagoreans pursued scientific or parascientific inquiries that might have debouched in the mathematical disciplines. Archytas . . . appears to have been the first Pythagorean mathematician" (p. 34). The mathematical achievements which many presume Pythagoras and his first followers to have had are foisted upon them by neo-Pythagoreans (pp. 24-25) and Neoplatonists (e.g., Proclus, according to whom Pythagoras erected geometry into a *paidaia*; Iamblichus, etc.; p. 26).

But what of Aristotle's statement (see above, text II) that the Pythagoreans "devoted themselves to mathematics and were the first to advance this study"? Philip's answer: "mathematics" there is not to be taken in a strict sense as arithmetic or geometry but rather as number speculation, arithmology or, even, number mysticism.

¹⁰¹ Pp. 47-48. See the entire section, pp. 44-53 with notes 5-9; pp. 39-40 and note 4. Note that the Table of Opposites does not include any of the four elements of Empedocles or the basic Ionian opposites hot-cold, dry-moist (p. 55, n. 4).

¹⁰² P. 52. Philip mentions dualism/monism seldom and his position is not clear. See p. 46: no natural philosopher (including the Pythagoreans) prior to Heraclitus erects the opposites "into first principles as the *physis* of our world, so creating a real dualism of first principles. As on Olympus, for all its dissensions and conflicts, there was one rule and one only, so in Presocratic thought there is one *physis*. The importance given by Aristotle to the opposites in his account of the Pythagoreans must not mislead us into thinking that their opposites were the first principles of a dualistic cosmos. Their cosmology had to take the form of a generation in time and so the opposites, for them as for other Presocratic

Anaximander explained the relation of our earth to the sun and moon in terms of number relations and mathematical symmetry. Pythagoras went further. He maintained that the cosmos was not only expressible in terms of number, but *was* number. But there were neither means nor methods of quantitative observation. All that could be done was to look for "correspondences." In the physical world this could lead to few correct observations and must lead to much fantasy.

Of more importance was an interest in the nature of number; in unit, dyad, triad, tetrad, each as a self-subsistent entity having a character and properties of its own; in the way numbers can be combined; in square, oblong, prime, amicable numbers; in short, such interests as are reflected in the definitions prefacing Euclid's Seventh Book. This was the only field in which the Pythagoreans could be said to have advanced mathematics. It is precisely the field we find reflected in Plato's mathematical speculations such as the Nuptial Number and the number theory of his later years (p. 79; also see p. 103, 2nd prgr.; pp. 205-206, 207).

Philip's denial to initial Pythagoreans of knowledge of strict mathematical sciences (especially, of geometry) induces him likewise to refuse Raven's "geometrical" interpretation of texts I, II, V and VI. Those passages, he claims, have been pressed to yield more detail of Pythagorean doctrine than they can. According to text II, number comes from the One. According to V and VI, the One *qua* universe breathes in from the infinite void that surrounds it, and the void it inhales serves to fill the space by which number-things are separated off one from another. But how are we to envisage the production of numbers?

Are we to have recourse to the analogy of animal generation favoured by the Cornford school? But how then can the One function as male principle and the void as female? And what numbers will be generated? The numbers up to ten and then a repetition? How will things be differentiated? There is nothing but the term ἐπεξῆς (which need not have this connotation) to justify the suggestion of *KR* 253 that the discrete quantities arising from inhalation are points, lines, etc. (p. 71, n. 4).

He summarizes:

Aristotle's account of the Pythagoreans represents them as having para-arithmetical and not geometrical interests. The point-line theory [see text I]

thinkers, had to precede their *physis*. But they preceded it as two opposed forces the interaction of which produced its life."

Philip's reasoning against dualism is unconvincing. Pythagorean opposites were *peras/apeiron*, which they did erect into first principles of our world, as he himself admits (p. 47): the Pythagoreans "were less concerned with contrariety than other thinkers of their own time, except in one important respect. The idea of Limit/Unlimited appears to have been fundamental. From that one pair of contraries they generated both the universe and number." Accordingly, Pythagoreanism does seem to be a "real dualism of first principles." Also see p. 50.

suggests a background of geometry. It is unlikely to be early Pythagorean, and even if later Pythagoreans adopted it, nevertheless, its origin would be Academic. But in fact Aristotle nowhere says that the Pythagoreans held this theory. The commentators cite the Pythagoreans for it only because it was an established feature of their [own] tradition (p. 102, 3rd prgr.).¹⁰³

Philip makes a rather striking observation. Plato had a theory of how numbers are derived from first principles, namely, from the One and the "great and small" (which actually he substituted for the Pythagorean *peras/apeiron* precisely in order to generate number). But the Pythagoreans had no theory, contenting themselves with the statement that things are numbers. But for Aristotle if there were a Pythagorean account of number-derivation,

it would be after the manner of Plato's and not simply the point-line-surface-solid scheme so often attributed to them by later tradition Plato has a unity like that of the Pythagoreans but paired with it is a duality having the capacity to produce two's. Unity and duality together generate number. The Pythagoreans's unity on the other hand is the product of *peras* and *apeiron*, there being no substrate. This unity when constituted ("how they cannot say") in its turn generates number-things by breathing the void. Why should the products of its generation be either number or things? (p. 92)

Quite obviously, Philip considers Raven's interpretation to be unsatisfactory. What does he offer in its place?

He summarizes his own reading of Aristotle (whom he considers to be sketching early Pythagorean doctrines, even Pythagoras' own: pp. 34, 53, 69-70, 93, 173) in several places. On pages 50 to 53 Philip is mainly interested in *peras/apeiron* as Pythagoras' primary opposites.

Limit is conceived of as an active force operating on (a passive) Unlimited to produce the One, our physical world. Then, the One having come to be, Limit persists in its active role, drawing in to itself the nearest part of the Unlimited, elsewhere (1048b10) equated with the Void. At the same time, under the guise of *chroia*, Limit has the further role of surface or limit of things. It is at once a cosmological first principle, a principle creating discrete quantities . . . and the exterior surface of these quantities (p. 50).

The primal opposition between *peras/apeiron* has three roles to play. "In its cosmogonical role the interaction of these contraries produces the physical world. In its physical role they are the material cause of our world. In its quantifying role, they are the existents of our world and the space separating them" (pp. 51-52).

¹⁰³ For additional rejections of the point-line theory as belonging to early Pythagoreanism, see pp. 10-11; p. 41, n. 10; p. 72, n. 6; p. 101, n. 10, where he explicitly mentions KR 252-56; p. 103, n. 11.

Despite the title of Chapter Five, "Pythagorean Cosmology," Philip there appears concerned mainly with cosmogony. Aristotle's account in Book A of *Metaphysics*, which is remarkably consistent but incomplete (p. 60), implies three temporally distinguishable phases in the Pythagorean description of the physical world: "first pre-existing opposites, then the constitution of a cosmos and finally a universe . . . in operation" (p. 61). It need not surprise us that these phases occur in time.

In the centuries between Hesiod and Plato cosmologies usually attempted to explain the nature of the world by the device of a sequence in time. The Pythagoreans were no exception in this. *Peras* and *apeiron* as their primordial first principles had subsumed under them respectively oddness and evenness, qualities in virtue of which the primary opposites were enabled to produce a number-determined One (986a18-21). This One, the product of the imposition of Limit on the Unlimited, did not use up the Unlimited, some of which remained outside the cosmos as a void, which the One breathed in to fill the space between things.

It was the third phase that most puzzled Aristotle (and puzzles us). From the One, which is both odd and even, proceed numbers. These numbers are physical existents (987b28). They are at once cause and substrate, modifications and states in the things that exist (986a17) . . . Everything is number. There are particulars within our cosmos only because of quantitative differences and because there is a void which separates entities one from another (p. 61).¹⁰⁴

Philip dwells on the puzzlement just mentioned in subsequent paragraphs. Aristotle does not tell us what physical state preceded the generation of the cosmos, nor how the cosmos was generated, presumably because Pythagorean sources themselves were vague. If he could have discovered in their teaching the embryo of efficient or final cause, he would likely have noted it in his discussion of causes. But we are told only that the One was generated "from plane surfaces or from surface limits or from seeds or from some other unexplained constituent." And this list of candidates for physical equivalents of *apeiron* is Aristotle's own (p. 67).¹⁰⁵ Actually,

¹⁰⁴ Philip allows *apeiron* to be equated with void but not with time, which he considers to be unauthentically Pythagorean and to have been a doxographical introduction. See p. 71, n. 4; p. 72, n. 8.

¹⁰⁵ Also see Philip's comment on *Metaphysics*, 1091a15 (*supra*, text V): "Had the One internal constituent parts, such as planes or surfaces or seeds? If we interpret this question of Aristotle, he expects them to say that their universe is constituted of geometrical elements (like those of the *Timaeus*), or of body surfaces (as for the Atomists), or of seeds (as for Anaxagoras). In each case he implicitly refers to these preceding thinkers by the term he uses, and he suggests that he finds nothing analogous to these minimum constituent parts in the case of the Pythagoreans" (p. 90). See p. 99, n. 7, 5th prgr., where Philip rejects Guthrie's equation of seed with the *gonimon* of Anaximander as lacking textual basis in Aristotle.

Philip adds, the Pythagoreans probably felt no need to explain how the Limit, together with the Limitless, became operative in time. "If it was divine and instinct with life it would originate its own processes, and there would be no need of 'plane surfaces, or surfaces, or seeds'."¹⁰⁶

Despite the mystification which Aristotle and he experience, though, Philip terminates this section by admitting that Aristotle found Pythagoreanism to be remarkable for doctrinal simplicity and consistency (p. 68). Simplicity becomes in fact an argument for an early dating of their theory, which "has no place for physical elements, nor for processes such as condensation and rarefaction. It ignores the problems of Parmenides and of Heraclitus. It seems unlikely that it would be untouched by the controversy of the fifth century" (pp. 69-70) and, accordingly, it should be dated before they arose.

In the third place in which Philip summarizes his own position (pp. 79-80), he merely comments again on the absence of Pythagorean explanation and on the simplicity of Aristotle's account.¹⁰⁷ In Philip's final summary (pp. 90-95 with notes) we again meet most of the points already listed: the threefold cosmological process, marked by extreme simplicity (p. 90);¹⁰⁸ the inability of Pythagoreans to explain "how the One was constituted as an extended unit" (*ibid.*); the likelihood that Pythagoras would have preferred Plato's derivation-theory from the One and indefinite dyad to the point-line-surface-solid scheme (p. 92). What is new, though, is Philip's discerning a kinship between Pythagoras' *apeiron* and Anaximander's.¹⁰⁹ Such kinship is possible since we may assume that "Pyth-

¹⁰⁶ P. 67. Philip continues with a comment which might seem contrary to his anti-mathematical interpretation of Pythagoras: "What Aristotle does tell us of the phase preceding the generation of the cosmos is that it was not merely by the operation of Limit on the Unlimited, but by the operation of Limit *qua* Odd on Unlimited *qua* Even that the One was constituted in the beginning. The first principles were mathematically conditioned. Etc." This "mathematical conditioning" Philip would have to interpret as pointing to arithmology rather than to geometry or other strict sciences of mathematics.

¹⁰⁷ Also see p. 99, n. 7 for other aspects of their theory for which the Pythagoreans present no explanation.

¹⁰⁸ On p. 90 there occurs the unintelligible or, even, downright erroneous description of *peras/apeiron* as "number-determined" (also see p. 91). How could they be so determined if they are prior to all numbers and their font?

¹⁰⁹ He had posed the question earlier of this kindship but left it unresolved: p. 67. He re-affirms the kinship on p. 179.

Philip seems to express himself inconsistently *re* Anaximander's Infinite. On p. 72, n. 7 he speaks as though *to apeiron* would demand *peras* in Anaximander also: "If our physical world is generated out of the *apeiron* the term itself would suggest, and indeed imply, *peras*. . . . If you have an *apeiron* you have a *peras*." But on p. 108, 2nd prgr.: "Anaximander had, as his first cause, only the *apeiron* . . . whereas the Pythagoreans certainly had as their primordial substance, principle,

agoras either 'heard' Anaximander or read his writings, and that the companion notions of a Boundless and of mathematical determination will have made particular impression on him" (pp. 94-95).¹¹⁰

What, then, is Anaximander's *apeiron*? "An infinite reservoir of matter, external to our universe, that can be – and is – drawn on to maintain physical process. We have already encountered a similar idea in the breathing in of the *apeiron* which Aristotle [text VI] ascribes to the Pythagoreans. This *apeiron* we must imagine as either identical with, or as some modification of, that of Anaximander" (p. 108, 1st prgr.). There are differences between the two, of course. In the Anaximandrian conception *apeiron* "is the sole first principle, containing and governing all things." Also, it is divine because immortal and imperishable (Aristotle, *Physics*, 203b11-15). Pythagoras' *apeiron* cannot be the sole *arche* because it shares honors with *peras*. Moreover, "it is unlikely to have had divine status or to have carried that epithet when the principal function of *peras/apeiron* is to produce the One and discrete quantity, and to aliment the universe" (p. 108, 3rd prgr.).¹¹¹ Despite diversity, though, Pythagoras' *apeiron* is like Anaximander's and is its descendant.

or cause, the two terms of the contrariety *apeiron-peras*." On the fact that Anaximander's *to apeiron*, by meaning "intraversable," need not imply *peras*, see K. Ilting, "Zur Philosophie der Pythagoreer," pp. 114-18.

¹¹⁰ Philip immediately adds: "Thales, Anaximander, and Pythagoras may have come under the influence of Babylonian mathematics as a revelation of a new idiom in which the mind could express its thought" (p. 95; also see p. 175). According to his interpretation, though, mathematics for Pythagoras would have to equal arithmology rather than geometry, etc. See above, n. 106. For mathematics in Anaximander see Kahn, *Anaximander*, pp. 91-98. On Babylonian and Grecian mathematics, see Thomas Heath, I, 26-140; Otto Neugebauer, *The Exact Sciences in Antiquity* (Princeton: U. Press, 1952), Chs. II, IV and VI.

¹¹¹ His reasoning hardly seems cogent. Anaximander's *apeiron* also was the *arche* of a quantitative cosmos and its nurse without detriment to its divinity. Moreover, divinity in Anaximander was connected with immortality and imperishability (*Physics*, 203b14-15); surely Pythagoras' *peras/apeiron* are immortal and imperishable also and, therefore, divine. Also Philip's refusal here to allow Pythagoras's first principles to be divine clashes somewhat with his hypothesis on p. 67: "If it [Limit or, possibly, Limit/Limitless] was divine and instinct with life it would originate its own processes." Also see pp. 178-79 re divinity and soul.

Other scholars give little attention to the topic. Guthrie mentions divinity with reference to Cornford's contrast between "the One which was a first principle and regarded as divine" and "the unity which began the number-series and was a product of higher principles" (vol. I, 247; also see p. 306: the human soul's "kinship with the divine, universal soul"; vol. II, 114). Also see C. De Vogel, *Pythagoras*, p. 200: In Pythagoras' philosophy "the mathematical number as such already was the *theion*" (also see p. 204); G. Vlastos, "Pre-Socratic Theology and Philosophy," p. 115.

Conclusions

In the light of the previous section, Philip's understanding of Pythagoreanism manifestly differs from Raven's.¹¹² Is it more accurate? One's answer depends on two hypotheses. If indeed Pythagoras was not formally a strict mathematician (especially, if no geometer) and if his thinking retains some Ionian characteristics,¹¹³ Philip's interpretation makes sense.

As the result of the first hypothesis, the derivation of things by a geometrical process (the point-line-surface-solid scheme) seems improbable, and Pythagoras' own account may well have been arithmological, vague and uninformative.

According to the second hypothesis, he could have conceived of the infinite *à la* Anaximander and Anaximenes. As infinite breath or air it would be the perpetual, immense and inexhaustible source and sustainer

¹¹² He differs also from several others in varying degrees. To mention a few: Kurt von Fritz believes that even the sophisticated, highly technical theory of incommensurability was discovered by the early Pythagoreans: "The Discovery of Incommensurability by Hippasus of Metapontum," *Annals of Mathematics*, 46 [1945], 242; also see K. von Fritz's review of Philip's book, *Gnomon*, 40 (1968), 6-13. On the other hand, F. M. Cleve holds that even if the Pythagoreans were ignorant of solid geometry, they still could have linked the origin of natural bodies with various solids (earth with the cube, fire with the pyramid, air with the octahedron, and so on – see Aëtius, II, 6, 3; DK 44A15; see above, n. 84) through "purely planimetric construction" (II, 453). This "planimetric construction" relies on equilateral triangles: "Four such triangles join to a tetrahedron, eight to an octahedron, twenty to an icosahedron; six of such quadrangles form a cube; twelve of such pentagons, a pentagon-dodecahedron" (II, 454). See pp. 452-66.

Another scholar differing from Philip is C. De Vogel in her book with the same title as Philip's and published also in 1966 (see above, n. 78). She accepts evidence not just from Aristotle but especially from Timaeus, Aristoxenus, Dicaearchus, who are sources for Porphyry and Iamblichus (the last is especially important because of the four Pythagorean speeches he recounts; pp. 70-147, 299-306). She reaffirms Pythagoras' ability in mathematics and, especially, philosophy, which flows into his social and political activity with the people at Croton: "Pythagoras in fact must be imagined as a preacher . . . who knew how to persuade the people to lead sober and restrained lives. By what means? By the force of a philosophical theory, a cosmic view intensely experienced as the truth" (p. 246). Also see her review of Philip's book in *JHS*, 89 (1969), 163-65.

Philip (e.g., pp. 105; 122; 170, n. 16) rejects Burkert's position that Pythagoras was merely a Greek Shaman, although both he and Burkert give pride of place to Aristotle's evidence. For his rejection of the extreme scepticism of Erich Frank, *Platon und die sogenannten Pythagoreer* (Halle: Max Niemeyer, 1923), see p. 34; p. 56, n. 7. On the other hand he is in almost total agreement with W. A. Heidel, ("The Pythagoreans and Greek Mathematics," *AJP*, 61 [1940], 1-33), who actually anticipates him on many points. Also see E. Brock, "Die Philosophie der Pythagoräer," *Stud. Philos.*, 23 (1963), 29-50.

¹¹³ Influence by the Ionians is plausible since Pythagoras possibly did not depart from the Ionian island of Samos until after ca. 532, when he would have

encompassing the world.¹¹⁴ But Pythagoras' originality consisted in adding a second *arche*: the *peras*. This inhaled and drew in the *apeiron*, thereby limiting and determining it, structuring and (literally) transforming it into the numbers which constitute the various natures of material things. This addition was a sign that the era in which a single principle sufficed was passing. One and the same factor could no longer be material, formal and moving causes of reality. Philosophy was pointed towards making an eventually clear distinction between various sorts of causes, between the corporeal and the non-corporeal, between what is eternal-divine and what is merely everlasting. In early Pythagoreanism only a start has been made. Hence, *peras* and *apeiron* are still corporeal (see Philip, p. 90), concrete and this-worldly in nature.¹¹⁵ Still the ground is broken. Consistently Pythagoras' *peras* would furnish the formal dimension of reality, *apeiron* the material side. *Peras* would be efficient cause also: it inhales, breathes and draws in the unlimited. *Peras* would be active, *apeiron* passive. Although both are everlasting and imperishable and, apparently, both surround the cosmos, still only *peras* would be living and divine. Awareness of these primordial causes of the universe, discernment of the hidden numerical structure of existents – such is the truly salvific knowledge at which each soul should aim so that, through successively better lots in future existences, one can eventually achieve divine stature.¹¹⁶

Such, then, is a likely although tentative view of pre-Parmenidean Pythagoreanism which issues from reflection upon Philip's reading of evidence in Aristotle.

been ca. forty years old. For a discussion of dates, see Philip, pp. 93-94, 177, 179, 195-96; KR 272; G, vol. I, 173-75; C. De Vogel, *Pythagoras*, pp. 23-24.

¹¹⁴ One can profitably recall (see n. 91 above) that Guthrie linked Pythagoras' *apeiron* with air, which later cosmologists would distinguish as the fifth element. See G, vol. I, pp. 271-73, especially p. 272; also p. 470; vol. II, 30; T. G. Sinnige, pp. 59-60.

¹¹⁵ These characteristics they will completely shed only in later Pythagoreanism when philosophers (e.g., Plato and his Academy) will have fully articulated the incorporeal, the abstract, the transcendent. For a survey of the history of Pythagoreanism, see Philip, pp. 8-23, 172-81; C. De Vogel, *Pythagoras*, pp. 192-217 (one should note, though, that she identifies Plato's doctrine of One/dyad with "the Ancient Pythagorean doctrine of *peras* and *apeiron*"; pp. 202-203).

¹¹⁶ On the Pythagorean theory of the soul (transmigration, immortality, kinship with all living things, etc.), see Philip, pp. 151-71, 178-79; KR 222-24, 261-62; G, vol. I, 306-319; G. Vlastos, "Pre-Socratic Theology and Philosophy," pp. 110-112; M. Detienne, *La notion de daimôn dans le pythagorisme ancien* (Paris: Société d'Édition "Les Belles Lettres," 1963), *passim* (Detienne's thesis is that the soul as a *daimon* constituted an important doctrine in early Pythagoreanism; for a helpful review of the book, see C. B. Kerferd, *CR*, n.s. 15 [1965], 77-79).

CHAPTER IV

THE ELEATICS

PARMENIDES

In summarizing current scholarly literature on Parmenides, one could write the same word as used previously to describe the state of Pythagorean studies: "controversy." In 1959 the Dutch scholar, J. H. M. M. Loenen, admitted that "almost everything is still problematic." He listed as problems the third way (e.g., whether this is directed against Heraclitus), the structure of Fragment 8, the relationship between being and thinking (Fr. 3), the place and meaning of Fr. 16, the subject of *estin* and the meaning of *to mē eon* (Fr. 2), the relationship between being and light, the relation between truth and opinion, and so on.¹¹⁷ The situation has not changed radically since 1959. Let us sample some relevant literature beginning with the fourth edition of John Burnet's *Early Greek Philosophy* (London: A. and C. Black, Ltd., 1930) and ending with Leonardo Tarán's *Parmenides: A Text with Translation, Commentary and Critical Essays* (Princeton, New Jersey: University Press, 1965). Such sampling will help clarify our own position, also.

¹¹⁷ P. 6. Also see Hermann Fränkel, *CP*, 41 [1946], 168): "...all the riddles with which the remnants of Parmenides' poem are beset; indeed, there are some of whose solution we may have to despair."

For a survey of interpretations of Parmenides the books to be analyzed in this section are very helpful (Guthrie, Loenen and Tarán especially give much information *passim*). Also see Thomas Schick, "Check and Spur: Parmenides' Concept of (What) Is," *CJ*, 60 (1964-1965), 171-72; Bohdan Wiśniewski, "Sur la signification du *eon* et de la *doxa* chez Parménide," *RIL*, 98 (1964), 63-65; J. Mansfeld, *Die Offenbarung des Parmenides und die menschliche Welt* (Assen: Van Gorcum & Co., 1964), pp. 45-55, 123-27, 146, 168, 249-60 and *passim* (as A. A. Long, *PQ*, 16 [1966], 269 rightly says, "Much of this book is taken up with summary and criticism of previous work on Parmenides"); E. D. Phillips, "Parmenides on Thought and Being," *PR*, 64 (1955), 546-56 (*re* Burnet, Cornford, Calogero, H. Fraenkel, Zafiropoulou and Schrödinger).

Burnet, Raven and Guthrie

The stand Burnet takes represents one extreme. According to this British scholar, the "what is" of which Parmenides speaks (Fr. 2) is without doubt "what we call body. It is certainly regarded as spatially extended; for it is quite seriously spoken of as a sphere . . . Parmenides does not say a word about 'Being' anywhere, and it is remarkable that he avoids the term 'god' The assertion that *it is* amounts just to this, that the universe is a *plenum*; and that there is no such thing as empty space, either inside or outside the world" (pp. 178-79).¹¹⁸ The Greek author goes on to develop all the consequences of the admission that *it is*. "It must be uncreated and indestructible It cannot be more or less. There is, therefore, as much of it in one place as in another, and the world is a continuous, indivisible *plenum*. From this it follows at once that it must be immovable It is hemmed in by *what is*, by the real, on every side. For the same reason, it must be finite, and can have nothing beyond it. It is complete in itself, and has no need to stretch out indefinitely into an empty space that does not exist. Hence, too, it is spherical" (p. 181). To sum up: "What *is*, is a finite, spherical, motionless corporeal *plenum*, and there is nothing beyond it" (p. 182). Accordingly, Parmenides is a materialist: "Parmenides is not, as some have said, the 'father of idealism'; on the contrary, all materialism depends on his view of reality" (*ibid.*). He elaborated his position, generally speaking, with the Pythagoreans in mind and it is extremely probable that the second part of his poem (Way of Belief) was a sketch of contemporary Pythagorean cosmology (p. 184).

J. E. Raven expresses in *The Presocratic Philosophers* (= KR) a more moderate attitude on some of these points. He grants that "the incorporeal was still unknown, and no vocabulary therefore existed to describe it." Nevertheless, Parmenides was "feeling his ways towards it." It seems probable that had he "been asked whether his 'Being' was solid (or 'body') his answer would have been a hesitant negative" (p. 270). What "properties of Being" can be deduced from his premise that "the only significant thought or statement is that a thing *is*" (p. 272)? Since that premise must "be eternally true, there cannot ever have been a time in the past, nor will there ever be a time in the future, when the statement *esti* is anything but

¹¹⁸ On Parmenides' avoidance of "god," see W. Jaeger, *TEGP*, pp. 107 and 108: Parmenides "definitely fails to identify Being with God." Nonetheless, Being possesses "perfect completeness, which is affirmed explicitly and which is the very thing that would impress the Greek mind as something of at least divine rank, even if not as a personal God." See below, n. 179; also Mourelatos, pp. 28, 44, 160-62.

true. It follows, therefore, that . . . the only time is a perpetual present time, and Being must of necessity be both uncreated and imperishable." Being is also immovable, one, continuous (p. 274). It is indivisible and homogeneous (*vs.* Anaximenes' doctrine of condensation and rarefaction and the Pythagorean doctrine of void; p. 275). It is motionless, resting in the same place, stable, equally poised. Above all, it is finite or limited, an attribute which Parmenides seems to take, together with unity and motionlessness, from the left-hand column of the Pythagorean Table of Opposites (pp. 276-77). In brief, Parmenides in the Way of Truth has taught us "all that reason, unaided by the senses, can deduce about Being. It is like a sphere, single, indivisible and homogeneous, timeless, changeless and, since motion is itself one form of change, motionless as well. It has in fact no perceptible qualities whatever" (p. 279). Immediately after that résumé Raven proceeds to the Way of Seeming.

His analysis of the Way of Truth seems not to have furnished much positive information. Being is not incorporeal and yet neither is it a solid or body. It is not created nor will it perish. It is not divisible nor is it in movement. It resembles but is not a sphere. It cannot be perceived. We are told what it is not, but what, positively, is it? Is a more definite and humanly satisfying reply possible? Guthrie, who admits that "it will be obvious to an informed reader how much I owe to . . . Mr. J. E. Raven" (vol. II, p. 49, n. 1), attempts a positive identification of Parmenides' Being: it is "the spherical solid of the geometer" (vol. II, 49).

This attempt occurs when Guthrie is commenting upon Fragment 8, 42-49: "But since there is a furthest limit, it is complete on every side, like the mass of a well-rounded ball, equal every way from the centre; . . . equal on all sides to itself, it meets its limits uniformly" (G, vol. II, 43). As the British scholar reads the passage, the problem is "how to interpret the reference to spherical shape and the spatial language of 'equal every way from the centre.' Are the 'furthest limit,' and the limits which it 'meets uniformly' . . . , limits of spatial extension? How, in short, did Parmenides conceive of his one true being? As purely conceptual, or as occupying space?" (vol. II, 45). Certain things, Guthrie realizes, are beyond doubt. The one true being "is grasped by intellectual insight, not by the senses. It is immutable and timeless, neither changing in quality nor moving in space. It is unique, completely homogeneous, and indivisible. All this shows plainly that it is not a body filling space with its physical bulk as, say, the earth does" (p. 45). But its not being a physical body does not necessitate one's saying that its limits "have nothing to do with spatial limits but are used figuratively to signify the *invariancy* of the one be-

ing.”¹¹⁹ Granted that being has no temporal limits, but, according to ideas current in Parmenides’ era, it must have some sort of spatial limits if it is to exist completely (p. 46). According to a typically Hellenic idea, completeness was attached to *roundness*, whether spherical shape in solid bodies or circularity in surfaces or motion, because anything round turns back upon itself completely (p. 47).

Guthrie interrupts his reflections on roundness to mention two Pythagorean contributions to Parmenides. They offered him a cosmogony in which the *apeiron* separated things and nourished them. Parmenides rejected it outright. Nothing keeps things apart, since reality is one and continuous. Nor is there any outside source of nourishment, whether called void or breath: the universe is complete and without deficiency. In short, “there is no unlimited (*apeiron*); the *peirata* embrace all that is; and this ‘unlimited’ which Parmenides has abolished was at the same time physical matter, empty space, and time or duration” (p. 48). The Pythagoreans, influenced by the discovery of the part played by mathematical laws of proportion and harmony in the ordering of the cosmos, also offered him the insight that things are numbers. “From the monad and the unlimited,” they explained, “spring numbers, from numbers points, from points lines, out of which surfaces are formed, out of surfaces solid figures, and *from these, perceptible bodies*.” Parmenides refused the last four words because of the leap they implied from the geometrical solid to physical nature. For the Pythagoreans the cosmos was

a sphere, containing other spheres within it, all of them revolving, and all containing visible and tangible body, composed of fire, water, air and earth. Parmenides retained the geometrical basis of all this, but denied the illegitimate leap from the intelligible geometrical figure to the moving and perceptible world. His reality is the spherical solid of the geometer, now for the first time separated from its physical manifestations, an object of thought, not sense (p. 49; also see p. 53).

In Guthrie’s view, then, the realm of truth which the goddess in Parmenides’ poem has disclosed, is “something utterly different from the world in which each one of us, including Parmenides, supposes himself to

¹¹⁹ Guthrie is here arguing against G. E. L. Owen, “Eleatic Questions,” *CQ*, n.s. 10 (1960), 95-101, who equates *peras* with invariance in time and space while grounding his denial that Parmenides’ arguments set up a spherical universe. The Eleatic, according to Owen, compares being to a sphere “because there is nothing true of it at one point or in one direction that is not true elsewhere. Its uniformity is like the perfect balance of a ball about its centre” (p. 99). Being (the subject of B 2.3) is “what can be thought or spoken of” (pp. 94-95). For a judicious critique of Owen’s article, see Mourelatos, pp. xiv, 271.

live" (p. 51). But despite the difference it has an analogy with something as contemporary and important as modern physics.

The realm of truth is rather like the mathematical model or world-image of the modern physicist with its relationship to the physical world reversed. For some physicists, at least, the model is "merely an intellectual structure. To a certain extent it is arbitrary." "The world-image is due to our imagination and is of a provisional and changeable character" [Max Planck, *The Philosophy of Physics*, 50 and 68]. This world-image contains only mathematical magnitudes, which are perfectly definable but never observable, in contrast to the physical world which may be observed but never precisely measured or defined. Reverse the relationships, call the physicist's model reality and the physical world a construction of the human intellect and imagination, and we shall approach very closely to the Parmenidean ontology. It was an astonishing achievement (pp. 51-52).¹²⁰

Joseph Owens

Two years after Raven first published *The Presocratic Philosophers*, a Canadian scholar, Joseph Owens, also endeavored to identify definitely the Being which figures so prominently in Parmenides' poem.¹²¹ In his first way of inquiry Parmenides is concerned with "being" and, moreover, he "continually speaks as though *that* which is and its *being* are identical" (p. 61). Whatever makes being be being is identified with that which has being.¹²² Although Parmenides expresses being by "is" (*estin*) solely, still "he has to *imply*, of course, a subject that is, but he seems careful to speak in a manner that does not commit him to any distinction whatsoever between that subject and its being" (pp. 61-62). But what is the subject which coincides with its being? It is "the world of sense experience, the world that includes one's self and all other men and visible and tangible things, the world that preceding thinkers from Thales on had studied and described. The cosmos apparent to all would obviously be taken as that which is and can be" (p. 62).

The subject of being having been located, what is being? It has several

¹²⁰ Both F. M. Cornford and A. H. Armstrong had anticipated Guthrie in identifying Being with a geometrical sphere. On Cornford, see *PP*, pp. 44-45 and "Parmenides' Two Ways," *CQ*, 27 (1933), 103-107. On Armstrong, see *An Introduction to Ancient Philosophy* (London: Methuen and Co. Ltd., [2nd ed.] 1949, p. 13. Also C. H. Kahn, *Gnomon*, 40 (1968), 132. But see G. B. Kerferd, *CR*, 80 (1966), 366: "There is no positive evidence for a purely geometrical approach in the case of Parmenides' sphere"; *idem*, *PR*, 76 (1967), 521.

¹²¹ *History*, pp. 56-78. Other scholars seem to have taken little notice of Owens' position. An exception is T. Schick, "Check and Spur," pp. 170-73.

¹²² Owens repeats this identification also on pp. 64-66.

attributes or signposts. It is incapable of any becoming or perishing because of its absolute completeness due to the complete identity between subject and being (pp. 63-64). It is not divisible because it is completely full of being, continuous and homogeneous: "(What) is allows no room for any heterogeneity whatsoever. It is described here as a sort of quantitative continuum, yet it is a continuum that is in no way divisible" (p. 65). It remains always in the same place because "being is in no way incomplete or indefinite, for it is not lacking in anything.... It is complete, in the manner of something extended that leaves no room for any further possibility of extension" (*ibid.*). It is "from every side complete 'like the mass of a well-rounded sphere, equally balanced from its centre in every direction'." This quotation from Fragment 8 (lines 43-44) is not to be understood in a mathematical sense, since "what concerns Parmenides primarily in the sphere simile is the *bulk* of the sphere [and besides] any mathematical solid would be obviously divisible" (p. 66, n. 15). Rather, the quotation means: "Being is limited to the uttermost degree and there is no not-being that could anywhere prevent it from reaching its limits equally. – Here perfection and limitation are equated, apparently after the Pythagorean manner, in the sense that definiteness is perfect and indefiniteness is imperfect. Being is everywhere limited to being, and so is everywhere definitely and perfectly being. (What) is is completely self-identical" (p. 66).

But if being is an indivisible quantitative continuum and yet is not a mathematical solid, what is its more definite nature? Being is physical light, according to Owens' discussion of the "Way of Mortals" (p. 67 sq.). The first of the two forms men set up as explanations of the universe is "flame or fire or (Fr. 9.1) light. It is described as 'the same as itself in every direction.' This coincides with the description of being, from the viewpoint of perfect self-identity. Like being, moreover, it is emphatically 'not the same' as its opposite [darkness]... Parmenides speaks as though light and darkness were respectively being and not-being" (p. 68).

Moreover, human knowledge itself, as well as one's conscious identity as an individual, is explained through the varying combination of light and darkness. Light predominates "more and more in some cases, as for instance in Parmenides when he was being borne aloft from the region of darkness into the region of light.... Light is therefore identified with knowledge as well as with being" (p. 70).

What this boils down to, Owens concludes, is that Parmenides is both philosopher of nature and metaphysician. He is the first because his poem undertook "to explain the visible and tangible universe, the universe that the Ionian thinkers before him had endeavored to probe. It shows no in-

terest in any other reality" (*ibid.*). Yet he is also a metaphysician because

he centered his whole attention on the aspect of being that was so evident in the world as he saw it. Probing that aspect deeply and earnestly, he saw clearly how real that being was, and he could not look upon it otherwise than as a reality itself. Viewed in that way, it at once began to pulverize everything it touched, and to absorb all things into its own all-embracing and undifferentiated unicity, including the sensible things from which Parmenides' cognition started. In poetic inspiration the Eleatic saw it as the form of light, light that extended throughout space in the great well-rounded sphere of the heavens, yet reached from place to place instantaneously just as in human cognition distant things are as present as close ones, without any discernible motion. Being, knowledge, and light coincided in their characteristics and were looked upon as the same nature.

Since Parmenides had no notion of any kind of reality above the sensible, this could only mean that being and knowledge were a physical reality, a natural form, light (p. 71).¹²³

Loenen

Writing in the same year as Owens (1959), J. H. M. M. Loenen definitely identified Parmenides' being also but in a unique fashion.¹²⁴ He begins his discussion by altering ἔστιν τε in Fr. 2, 3 to ἔστιν τι, thereby furnishing "something" (*ti*) as the indefinite subject of the verb (pp. 4, 12-14).¹²⁵ The sentence then means: "There exists something which *is* in a strict sense and it is not possible to assume that it is not" (pp. 14-16). What does "is in a strict sense" signify? That something is eternally, immutably, necessarily (pp. 15-22).¹²⁶ But what is the "something" which exists

¹²³ On Parmenides' insight into light as possibly arising within poetic inspiration, also see p. 75. W. J. Verdenius connects Being with spiritual rather than physical light. See "Parmenides' Conception of Light," *Mnemosyne*, 2 (1949), 116-31, especially 128-31. (For a critique, see Loenen, p. 116, n. 246). Later Verdenius replaces light with truth, which "in this context is not a logical category but is to be understood as the true nature of things" ("Parmenides B 2, 3," *Mnemosyne*, 15 [1962], 237). In his book, *Parmenides: Some Comments on His Poem* (Groningen: J. B. Wolters, 1942), he expresses the opinion that the grammatical subject of *estin* is reality, understood as "all that exists, the total of things" (p. 32, n. 3). Mourelatos argues against identifying Being with light – see pp. 241, 244.

¹²⁴ For publishing data on his book, see "Abbreviations" *supra* or "Bibliography" *infra*. Reviews of his book are listed in *L'année philologique*, vols. 31 and 32 (1960 and 1961). Denis Grey's is especially good: *JHS*, 81 (1961), 184-86.

¹²⁵ This corruption of *ti*, Loenen suggests (p. 49, n. 91), would have occurred in the manuscript of Parmenides' poem after Gorgias and before Plato. For a survey of interpretations of Fr. 2, 3, as well as Fr. 2, 5 and Fr. 8, 2, see Mourelatos, pp. 47-55 and 269-76. For Mourelatos' own position on *esti* as involving "speculative" predication, see pp. 56-73.

¹²⁶ Nonbeing (*to mē eon*) is not to be understood as absolute nothingness but rather as all that which is contingently and mutably. Nonbeing is "all reality with

strictly? Loenen's answer: it is νοεῖν—a thinking-knowing (pp. 33-39) which is identified with the content (*noēma*) of its thought (pp. 40-42), which in turn is exclusively the idea of being (pp. 42-45).¹²⁷ Being strictly and properly understood, then, is not a reality existing entirely independent of thought (p. 43)¹²⁸ but is the idea of being. It is being itself as apprehended by the mind (pp. 45-46; see résumé, pp. 48-49).¹²⁹

This equation, "being = idea of being," unlocks all the attributes of being. Being is "complete of limbs" (Fr. 8, 4: οὐλομελές): even though there seems to be a plurality of ideas of being in view of the endless series of propositions referring to the multiplicity of concrete things ("A is a being," "B is a being," etc.), nonetheless there is "only one idea of being. The second idea thus adds nothing to the first, it coincides entirely with it, and in the same way all coincide in the one whole. This is Parmenides' attempt to formulate the aprioristic unity of the idea of being in a still somewhat primitive way . . . The many ideas of 'being' which threaten to arise form as it were the limbs (μέλεα) of the whole" (pp. 66-67). Being is immutable and immovable also (Fr. 8, 4: ἀτρεμής and Fr. 8, 38: ἀκίνητον) because "even the greatest conceivable differences between concrete things, with reference to which the idea is conceived in each

the exception of that 'something which is.' Briefly, by this term Parmenides must mean what we may broadly term 'the phenomenal world,' or 'concrete thing'" (p. 24). Accordingly, Parmenides' "philosophy is from the outset a dualism" (p. 28). Loenen substitutes dualism for monism frequently: pp. 5, 70, 82, 103, 117, 124. For a different interpretation see Mourelatos, pp. 230-33.

¹²⁷ For translations and interpretations of Fr. 3 (τὸ γὰρ αὐτὸ νοεῖν ἔστιν τε καὶ εἶναι), see p. 33, n. 58. Loenen's translation is: "For *noein* and being *s.s.* are the same thing" (p. 33).

If the sole content of *noein* is the idea of being, then "the act of thinking other ideas for Parmenides is no *noein*" but rather mere empty "naming" (pp. 44-45). For Loenen's theory that Parmenides developed his view on true thought as concerned solely with the idea of being in lacunae between Frs. 3 and 6, see pp. 50-60. The original ordering of the Fragments would then be: Fr. 3; Fr. 16; small lacuna; Fr. 5; small lacuna; Fr. 4 (p. 72).

¹²⁸ Such as matter (Burnet), physical light (Aristotle, J. Owens [although Loenen does not name the latter]), spiritual light (Verdenius), "abstract being, common to all things as their true reality (Riezler)" (p. 46).

¹²⁹ This statement might lead one to call Parmenides an idealist. This would be an error, though. He is an "epistemological rationalist." See pp. 45 and 48: "The very fact of its being self-evident to Parmenides . . . that there exists a reality transcending consciousness explains sufficiently why he failed to make a distinction between the logical and ontological aspect. Parmenides therefore is not to be considered the founder of idealism. On the other hand he *may* be called the father of epistemological rationalism, since he is the first to have assumed that true knowledge does not spring from experience."

case, are irrelevant" (p. 73) and because it is extra-spatial (pp. 72-74). It is "without end" in time (Fr. 8, 4: ἀτέλεστον): "temporal differences occurring between several mental processes do not prevent the fact that the idea of being is (numerically) one . . . that it is 'present all at the same time now' . . . Parmenides must mean that the numerous ideas of being which arise successively one after the other nevertheless combine to form an uninterrupted . . . unity, that they coincide in one idea" (p. 74).

Those three attributes are derived "from an analytical description of the idea of being." Others, though, must be deduced from those attributes "and more particularly from the all-comprehensive predicate being *s.s.*" (p. 99). The first such deduction (Fr. 8, 3-21) is that being cannot "have come into being in the past, nor will it pass away in the future" (ἀγέννητον . . . ἀνώλεθρον) because, as we have just seen, it is complete, immutable and extra-temporal (p. 100). Secondly (Fr. 8, 22-25), being is indivisible (οὐδὲ διαιρετόν) because of the self-identity of its content (p. 107).

The ideas of being succeeding each other in the mental process merge into or coincide with each other uninterruptedly . . . [Thus when I say first of a tree, "This is a being," and then of a stone, "This is a being,"] I do not have two ideas of being, but only one idea, for the second idea is an idea completely identical with the first from a qualitative point of view (ὁμοίον), however much the concrete tree and the concrete stone may differ from each other both qualitatively and quantitatively (pp. 105-106; see also pp. 66-67).

Finally, being is determinate (Fr. 8, 26: ἐν πείρασι δεσμῶν; see also l. 31), because "it is proper to the mind to think something definite" (p. 112) and because entity is coterminous with completeness and finishedness (Fr. 8, 32: οὐκ ἀτελεύτητον; Fr. 8, 42: τετελεσμένον). In fact, being is like a ball — a comparison in which "he intends to transcend all spatiality" (p. 108). Not only are qualitative differences denied (the many ideas of being do fully coincide), but quantitative differences are rejected as well.

One might perhaps think that one idea is greater or smaller than the other, in accordance with the greater or smaller quantity of concrete things which form the regular starting-point for thought. This notion, however, is rejected, and since the ball too is merely an image, one has to assume that he intends to exclude fundamentally all spatiality from the idea of being (p. 109).

Just as "the ball of the comparison is completely filled with matter," so too thought is full of the idea of being, which "comprises all possible and completely identical ideas of being in the unity of the concept and . . . there is no room in that for anything but the idea of being" (p. 61).

Tarán

Loenen's settling on the idea of being as the subject of which Parmenides speaks in the Way of Truth is certainly an interpretation which differs from those so far considered. Leonardo Tarán's position is no less singular.¹³⁰

"How should Fr. 2, 3-5, be interpreted?" Tarán asks. The verbs, ἔστιν and οὐκ ἔστιν, "are used as impersonals and no subject has to be understood with them" (p. 36). Hence, the translation: "The one [way of inquiry says]: 'exists' and 'it is not possible not to exist'...; the other [says]: 'exists-not' and 'not to exist is necessary,' this I point out to you is a path wholly unknowable" (p. 32). Accordingly, "Parmenides starts from the priority of the ontological problem. His point of departure is existence. The other way is impossible, for it asserts the existence of non-existence... for non-Being cannot be conceived or expressed" (p. 37).

Tarán adds that "existence" is synonymous with "being": "Parmenides states that there are two ways of inquiry that can be conceived: one asserts 'exists,' the other asserts 'exists-not.' The concept of existence is here expressed by a verb, but Parmenides could equally have said 'one way asserts Being'" (*ibid.*). Consequently, we may say that "Parmenides' Being is unrestricted existence and that this is his point of departure" (p. 124).¹³¹

But what constitutes "existence" or "Being"? What is the heart of its reality? Self-identity, absence of difference. Being is being and nothing but being. Only being is real. "There can be no difference in what exists, so nothing can be distinguished inside Being... Being is all alike because it can only be without restriction... Since it exists it does so without restriction because there can be nothing other than Being, for other than Being would be non-Being and this is impossible" (p. 107). Again: "Being

¹³⁰ For publishing data see "Abbreviations" or "Bibliography." Also see note 2 *supra*, which gives quotations exemplifying Tarán's blunt rejection of Aristotle as an historically accurate witness for the Presocratics. For a contrast between Tarán and Loenen, see below, n. 135. For excellent, balanced criticism of Tarán's book, see C. H. Kahn, *Gnomon*, 40 (1968), 123-33; Mourelatos, *passim* (see Index for twenty-five references to Tarán's book).

¹³¹ Tarán intends "existence" and "being" to be synonymous with "reality" too, I think. He does not wish to emphasize "existence" as such, whether taken to mean "standing out from" and restricted to men, as in radical existentialism, or meaning "be-ing actually," as in authentic existentialism. (See Leo Sweeney, S. J., "Existentialism: Authentic and Unauthentic," *New Scholasticism*, 40 [1966], 36-52; *idem*, *A Metaphysics of Authentic Existentialism* [Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1965], pp. 101-107, 305-307). In Tarán's view, as will be clear from the next paragraph in the text, "reality" or "being" or "existence" signify "identity" or, negatively, "absence of difference."

is the only thing there is, whereas if something other existed there would be difference and therefore reality would not be 'all alike' (*ibid.*). Somewhat later: "Being must forever be just identical with itself, which constitutes the ineluctable law of Being" (p. 117).¹³²

Next, can one describe Being more exactly? What is it, more precisely? Is it body or mind or what? On account of his conclusion "that what exists can have no characteristic except Being," Parmenides "is not interested in the question what may the existent be" and, in fact, "he actually denies the validity of such a question, for to say 'Being is X' would be tantamount to admitting the reality of difference, which difference from Being could be for Parmenides only non-Being and non-Being is for him inconceivable" (p. 193). Therefore, "the question of idealism or materialism is not a legitimate one to be put to Parmenides. He could not say 'Being is matter' or 'Being is thought,' because both statements presuppose the reality of difference" (*ibid.*).¹³³ If one should object that "for Parmenides thought is immanent in Being or that he could not conceive any kind of existence except that of a sensible body," the answer is that "the whole burden of his argument is that what exists can have no other characteristic than its existence. Parmenides' Being is neither matter nor thought. Parmenides' conception of Being, precisely because it asserts that Being can have no characteristic except existence, is the first attempt at the abstract" (pp. 193-94).

But if nothing can be predicated of Being, why does Parmenides himself say that Being is ungenerated, imperishable, homogeneous, continuous, immovable, unchangeable, complete, and unique? Why does Being have such signposts or predicates? "The answer is that the *σήματα* of Being are merely negative predicates, i.e., they deny difference and are only a

¹³² Also see Tarán, p. 279.

¹³³ Tarán's reasoning is not convincing. In saying, "Being is X," one does not affirm but denies difference. In positive statements one affirms that what is signified by the predicate is a characteristic of the subject (e.g., "This man is a mathematician") or, even, is essential to it (e.g., "John is human"). Hence, Parmenides might legitimately say, "Being is self-identity," meaning self-identity is the essential constituent of being. Conceivably he might also say, "Intellect [or body or a geometrical sphere or light] is self-identity," meaning that self-identity is concentrated in intellect in a pure state. J. Owens' insight into being as identical with its subject is relevant and helpful (see *supra*). Whatever makes being be being is identified with that which has or is being.

R. K. Sprague (*CP*, 61 [1966], 262) comments that in Tarán's theory "a really consistent Parmenides would have to sit still and say nothing but the one word 'Being,' if that" and would thus be "like the extreme Heraclitean, Cratylus, who refused to do anything except waggle a finger." Also see C. H. Kahn, *Gnomon*, pp. 129-32.

consequence of the self-identity of Being To deny one of them to what exists is by implication to assert the existence of non-Being. So the *σήματα* of Being are derived from the self-identity of what exists which is its immanent law" (pp. 194 and 193).

Before closing this section, let us briefly consider a few negative predicates in Fragment 8. What does Parmenides mean by Fr. 8, 22: οὐδὲ διαιρετόν ἐστιν? It signifies that "what exists is indivisible because it is all alike. 'Indivisible' does not refer to material division but is an ontological predicate of what exists It cannot be divided because there can be no difference in what exists, so nothing can be distinguished inside Being" (p. 106). Unrestricted being induces assent to homogeneity, which in turn leads to continuity.

Since Being is all alike, it is not possible to divide it nor is there more Being in one place that would prevent it from holding together, nor less, but all is full of Being. Therefore it is all continuous, since Being is in contact with Being. From the fact that there exists only Being without restriction it is deduced that Being is all alike, and from this it follows that Being is continuous

This continuity, however, should not be considered as spatial continuity . . . but only as the equal intensity of Being always and everywhere (p. 108).

What of Fr. 8, 32: οὐκ ἀτελεύτητον? This expression does not mean "finite" but "complete."¹³⁴ But why is Being complete? "Because it is not in need; if it were (in need), it would need all, i.e., it would need the only thing there is: Being. So when Parmenides states that Being is complete he does not mean that all the characteristics of the phenomenal world are included in it but only that what exists, unrestricted Being, is all that exists" (p. 119).

What is the force of "bonds" and "limits," which occur frequently in Fragment 8 (lines 13-15, 26-27, 30-31, 37-38, 43-44 and 49)? First of all, Parmenides did not intend them as physical or spatial limits. If he did, "he would have been confronted with the question, what is there beyond the limit, for he could have admitted neither non-Being (it is inconceivable) nor Being (because there would not be a limit); as for a *tertium quid* . . . Parmenides asserted that it was impossible" (p. 116). Since the two frequently recurring terms are synonyms (p. 116), they are in each case metaphorical assertions "of the fact that the bonds of logical necessity are the cause of the self-identity of Being [Parmenides] uses these

¹³⁴ Tarán's refusal to use "finite" as a translation for the Greek seems unnecessary. "Finiteness" and "limit" mean imperfection only in hellenistic and later contexts. Prior to that (e.g., in Pythagoreanism; see J. Owens, *History*, p. 66) they signify definiteness or determinateness and, thus, can be aligned with completeness and perfection. On Fr. 8, 32-33 and 42-49, also see Mourelatos, pp. 120-29.

expressions metaphorically to emphasize the fact that it is logical necessity that forces Being to be identical with itself" (pp. 117 and 151).

Still another figurative expression occurs in line 43: "like the body of a well-rounded sphere." Parmenides is not interested in the surface of the sphere or in an equality of radius. The point of the comparison with a sphere is "that Being is undifferentiated" (p. 158). Once it is seen that Being is complete from every point like the mass of a well-rounded sphere, the motive for such a comparison becomes clear.

The mass of a sphere in equilibrium around the middle is in all parts of equal strength. Such an equilibrium is obtained by the homogeneity of the mass, i.e. it is everywhere the same . . . That Being is complete everywhere means that everywhere it is just Being, and this preserves the identity of Being as the homogeneity of the sphere keeps it in equilibrium. Being is complete everywhere because everywhere Being is just Being (p. 159).¹³⁵

Conclusions

The survey just terminated has revealed that the quotation from Loenen with which we began (see above, p. 93) is justified. Almost everything in Parmenides' poem is indeed problematic, whether it be the Greek text itself (e.g., Tarán's readings for Fr. 8, lines 4, 12, 33 differ from Burnet's, Loenen's, etc.),¹³⁶ the original ordering of the Fragments (see above

¹³⁵ Both Tarán and Loenen speak often of "Being." Does the former's interpretation differ from the latter's? Yes, radically. For Loenen Being involves a thinking-process whose content is an idea of immutability, eternity, necessity and is expressed by the term "Being." For Tarán "Being" says "Being" (= self-identity) and nothing more. Intellection or thought-content or, as far as that goes, matter does not enter the picture at all. Being is free from positive characteristics and, thus, has overtones of blandness, neutrality, emptiness. Apparently it would resemble what Avicenna, as well as medieval Western Christian authors, will call an "absolute nature" or "a nature absolutely considered" – something considered just in those factors which make it essentially be what it is and apart from whether (for example) it exists intramentally or extramentally, from whether it is human or divine, whether mind or matter. In that light the absolute nature of Parmenidean Being would be Being viewed just as self-identity and nothing more.

As a sample of how Thomas Aquinas conceives "absolute nature," see *De Ente et Essentia*, ch. 3 (Roland-Gosselin ed., pp. 24-29, where the editor also furnishes abundant quotations from Avicenna). Also see J. Owens, "Common Nature: A Point of Comparison Between Thomistic and Scotistic Metaphysics," *MS*, 19 (1957), 1-14.

¹³⁶ For a list of Tarán's variant readings, see R. K. Sprague, *CP*, 262; C. H. Kahn, *Gnomon*, 123-24. On the Greek text found in DK see A. H. Coxon, "The Manuscript Tradition of Simplicius' Commentary on Aristotle's *Physics*, I-IV," *CQ*, n.s. 18 (1968), 70-75. Tarán's reading for Fr. 8, 4 (ἡδὲ τελεστόν) differs from

n. 127, second prgr.) or the interpretation of indivisibility and other attributes. Still another major problem is the identification of Being in Parmenides' Way of Truth. Is it body (Burnet)? a geometrical sphere (Guthrie)? physical light (Owens)? thought whose content is the idea of Being (Loenen)? or is such a question itself suspect since Being is Being and nothing else (Tarán)?

One of the reasons behind such controversies is not hard to find. Parmenides chose to express difficult philosophic doctrines in poetry. Although he "was a careful and singularly exact writer,"¹³⁷ and although we possess a higher proportion of his writings than of any other Presocratic philosopher (possibly nine-tenths of the Way of Truth and one-tenth of the Way of Seeming are extant, as well as the entire Proem; KR 266), still his choice results in poetic diction which is often exceedingly obscure (KR 265). It results also in figures of speech, which in any author yield literal and technical meanings only reluctantly. These our Greek poet does not confine to the elaborate allegory in the Proem but uses them also in the Way of Truth to describe Being as limited. For instance, "Justice looses not her fetters to permit [Being] to have come into being or to perish, but holds [it] fast" (Fr. 8, lines 13-15).¹³⁸ Lines 26-27: "Motionless in the limits of mighty bonds it [Being] is without beginning and never-ending." Lines 30-31: "Powerful Necessity holds it in the bonds of the limit which encircles Being." Lines 37-38: "Destiny fettered it to be whole and immovable." Finally, the famous sphere-simile: Being is "like the body of a well-rounded sphere, from the middle everywhere of equal strength" (lines 43-44).¹³⁹

T. G. Sinnige's (ἡδ' ἀτέλειστον), who reads the Greek as signifying "spatially unbounded" (pp. 34-38, 44-48) and thus equivalent to *apeiron* of Anaximander. H. Fränkel (vs. Stenzel) denies any such equivalence – see *Wege und Formen*, pp. 190-93; *Dichtung*, pp. 407-409. For Mourelatos' reading of Fr. 8, 4, see pp. 95-96 and note 6 (he agrees with Tarán).

¹³⁷ C. M. Bowra, "The Proem of Parmenides," *CP*, 32 (1937), 97.

¹³⁸ All the translations in this paragraph are Tarán's, who also provides the Greek text.

¹³⁹ Also see Fr. 10, 5-7: "You will know . . . also how Necessity guiding it [the sky] fettered it to hold the limits of the stars." According to Bowra, *ibid.*, p. 107, the Dike of the Proem is also the Dike and Ananke of Fragments 8 and 10. Also see J. Mansfeld, *Die Offenbarung*, pp. 240-45, 261-73 and *passim* (see "Dike" and "Göttin" in "Verzeichnis"), who makes the same identification and, in fact, gives the goddess a key role to play in all parts of the poem.

Possibly Parmenides personifies Justice, Necessity and Destiny as substitutes for the moving causes which he found in Ionian and Pythagorean theories but eliminated from his own. Such personifications allow him to portray reality dynamically but they remain extrinsic to it.

Another figurative expression Parmenides uses is, of course, ὅδος, which occurs

Under cover of these and other figurative expressions Parmenides is presenting "an unprecedented exercise in logical deduction: starting from the premise *esti*, 'it is,' . . . Parmenides proceeds, by the sole use of reason unaided by the senses, to deduce all that can be known about Being, and he ends by denying any truthful validity to the senses or any reality to what they appear to perceive" (KR 266). Moreover, the doctrine so deduced he intends "as a way comparable, and presumably superior, to the ways of religious sects" (Bowra, *CP*, p. 110), and his Proem he views as having "the importance and seriousness of a religious revelation" (Bowra, *CP*, p. 106; also see p. 112).

Little wonder, then, that Parmenides' poem has provoked variant interpretations. Nonetheless, some things appear rather certain and clear. Without doubt Parmenides was an historical figure. He was a Greek born ca. 515 in Elea in Southern Italy.¹⁴⁰ His intelligence and philosophic bent, as well as the intellectual climate of his times which fostered interchange of ideas, would surely guarantee his awareness of previous philosophical systems, which thus could and did have repercussions on his own thinking.¹⁴¹ The Milesians would have shown themselves positing a monism

eleven times in the poem (Bowra, *op. cit.* p. 108); also see Eric A. Havelock, "Parmenides and Odysseus," *HSCP*, 63 (1958), pp. 137-38. Havelock thinks that Homer rather than Pindar (vs. Bowra) was the principal influence upon Parmenides' poetry; see entire article, pp. 133-43; J. Mansfeld, *Die Offenbarung*, pp. 229-31; Hans Schwabl, "Hesiod und Parmenides," *RhM*, 106 (1963), 134-42; J. Kerschenshteiner, p. 122; Mourelatos, pp. 1-46, 260-63.

Javier Herrero, "Materia e Idea en el Ente de Parmenides," *RFil* (Madrid), 15, (1956), 262, calls Parmenides "poeta de la perfecta racionalidad." Also see A. H. Basson, "The Way of Truth," *Proc. Aristot. Soc.*, 61 (1960-1), 73-86; W. Burkert, "Das Proömium des Parmenides und die Katabasis des Pythagoras," *Phronesis*, 14 (1969), 1-30.

¹⁴⁰ See Tarán, pp. 35; KR 265; G, vol. II, 1-3.

¹⁴¹ Frequently, Tarán excludes such repercussions upon Parmenides. For example, the Greek author in Fr. 8, 12-13 is not attacking the Pythagorean concept of the void (pp. 97-101, 110-113). In Fr. 8, 22-24 Parmenides' reasoning goes beyond a mere attack on Anaximander, Anaximenes or the Pythagoreans. "No particular theory need be sought as the special object of Parmenides' polemic in this passage" (p. 109). In Fr. 8, 42-27 "there is no reason to suppose (in fact to do so obliterates the inner dialectic of Parmenides' thought) that Parmenides has any special thinker in mind" (p. 160). In general, "Parmenides' conception of Being has nothing to do either with Xenophanes or with the Pythagoreans" (p. 201).

Despite his "general tendency to cut Parmenides loose from his historical moorings" (R. K. Sprague, *CP*, p. 263), Tarán does grant that in Fr. 6, 4-9 Parmenides has in mind Heraclitus (pp. 61-62, 69-72). Other scholars make this concession not only *re* Heraclitus but also *re* many other predecessors of Parmenides. As one example consider Guthrie, vol. II, pp. 1 (*re* Xenophanes), 11 (Orphic and shamanistic influences), 15-16 (Milesians), 23 (Heraclitus), 30 (Milesians, especially Anaximander), 37 (Xenophanes), 38-39 (Homer, Hesiod, Anax-

inasmuch as all things consist basically of one factor (Anaximander called it *to apeiron*, Anaximenes air). Yet it was a monism which not only allowed things to be multiple but also viewed that multiplicity as originating from unity, either by some sort of mysterious "separating off" or by rarefaction and condensation. Even though it is an open question whether Heraclitus considered the logos-fire as an *arche*, still he did retain multiplicity by proposing that reality be viewed as unity-in-multiplicity, identity-in-diversity, agreement-in-contradiction. The Pythagoreans not only replaced Ionian monism with a dualism of limit/infinity. They also conceived sensible existents as having developed when *peras* inhaled and limited the *apeiron* which serves as breath, time and void surrounding the universe. Finally, all of those groups had to a greater or less extent relied on sense knowledge to provide data for their philosophic intellections.

Such, then, was the philosophical world-view which Parmenides inherited. His reaction was to drain off from it all difference and multiplicity, all motion and change, all separation and contradiction, all indefiniteness, imperfection and absence. He thereby disclosed a universe having neither temporal origin nor termination, a universe of absolute identity and unity, of total stability and permanence, of continuity and sameness, of determinateness, perfection and completeness. Such is the *Weltanschauung* he attempts to sketch in the Way of Truth. His own insight was that reality or being *is* unity, *is* originless and temporally endless immutability, altogether-now-in-presentness, coherence, fullness, determinateness. Their opposites – plurality, processes with beginning, middle and end, past or future absence, division, emptiness, indetermination – constitute unreality or nonbeing, which is inconceivable and indescribable.

Can one link Parmenides' Being with any one kind of thing? Is it mind or matter or what? Theoretically he need not have forged any such link, since it uncovers no new trait within Being itself and Parmenides was mainly interested in the intrinsic constituents of Being. In this sense Tarán's viewing Parmenides as concerned solely with Being and its negative predicates makes sense. After all, Parmenides' affirming Being to consist entirely of sheer homogeneity, unity, permanence, completeness, definiteness and so on is his unique contribution to the history of Greek thought.

imander), 48 sq. (Pythagoreans), 62 (Anaximander), 76 (Pythagoreans). Also see Denis Grey (*JHS*, 81 [1961], 185) for the intellectual "situation Parmenides inherits" and the investment he makes of it; J. Mansfeld, *Die Offenbarung*, pp. 32-41 (*re* Heraclitus), 120-21 (Pythagoreans), 197-203 (Anaximander and Anaximenes), 203-208 (Empedocles and other post-Parmenideans; Heraclitus); G. E. R. Lloyd, "Hot and Cold," pp. 98-99 (Parmenides and Anaximander); T. G. Sinnige, pp. 38-48 (Anaximander. Heraclitus, Pythagoreans).

But his poem itself, as well as our survey of his philosophical predecessors, suggests that he may have attempted some such connection. Being is not mind, though, despite what one seems to read in Fragment 3: τὸ γὰρ νοεῖν ἔστιν τε καὶ εἶναι. True enough, "the most natural interpretation of the fragment is the one based on its literal translation: 'For to think and to be is one and the same thing'" (Tarán, p. 41). Nevertheless, Zeller's analysis of the text seems better. The infinitives are used as datives and, consequently, the sentence literally translates as: "The same thing exists for thinking and for being." That is to say, only that which can be can be thought.¹⁴² Moreover, Parmenides was dissatisfied precisely because his predecessors had conceived reality as embracing activity and motion, which he proceeded to siphon from Being. But thinking is an intellectual activity and connotes change and some sort of differentiation between knower and known. Therefore, Parmenides would scarcely have re-inserted thought into reality by equating Being with mind.¹⁴³

What of Cornford's and Guthrie's contention? The spherical solid of a geometer is a likely candidate for identification with Being, since change is alien to it, it is homogeneous and continuous, it is contemporaneous and complete, it is definite. But, unfortunately, it is divisible. Perhaps, then, the most likely candidate is physical light, as Owens suggested after reflecting on Parmenides' concentration on light in the Way of Mortals. It enjoys all the advantages of a geometrical sphere, plus one: it is indivisible (at least as then conceived). But, as already indicated, our Greek author may

¹⁴² For an identification of Being with mind see G. Vlastos, *Gnomon*, 25 (1953), 168. Also see E. A. Phillips, "Parmenides on Thought and Being," pp. 556-60. On pp. 547-56 he gives an excellent analysis of Fr. 3, as well as of relevant verses in Fragments 2, 6, and 8. His equating of Being with mind is noteworthy: "If thinking and being are the same, then, first, everything that thinks is . . . [and] secondly, everything that is thinks . . . [Parmenides did not look on] Being as purely mental; rather, like Spinoza, he thought of it as essentially mental but also essentially extended; and further as shaped like a sphere, as well as having the formal properties of the One" (pp. 556 and 559). For Heidegger's interpretation of Fr. 3, see G. J. Seidel, *Martin Heidegger and the Pre-Socratics*, pp. 58-77; for H. Fränkel's, see *Dichtung*, pp. 417-19.

As opposing the identification, see Tarán, pp. 41-44; G., vol. II, 41-42; Cornford, *PP*, p. 34, n. 1; L. Woodbury, "Parmenides on Names," *HSCP*, 63 (1958), 145-60. On the meaning of *nous* and *noein*, see Kurt von Fritz, "*Nous, Noein and Their Derivatives*," *CP*, 40 (1945), 236-42 (*re* Parmenides). Also see C. H. Kahn, "The Thesis of Parmenides," *RM*, 22 (1969), 700-724; Mourelatos, Ch. VII (pp. 164-93).

¹⁴³ Such a re-entrance would take time. Even Plato did not introduce cognition itself into the realm of the really real until the *Sophist* in connection with Rest and Motion. See my next volume, *Infinity in Plato's "Philebus"*.

not have attended much to that question (although his poetry has overtones which sound otherwise at times).

More relevant to our purpose, though, is the attention Parmenides did give to *peras* in the Way of Truth. If Solmsen can accurately acclaim Anaximander for giving *apeiron* a central and dominating place ("Anaximander's Infinite," p. 114), we can with good reason acclaim Parmenides for championing *peras*.¹⁴⁴ Unlike the Pythagorean limit, it has nothing unlimited as partner. It does not inhale or structure. It plays no role in a genesis. It is the source of nothing subsequent. Rather, it *is* reality. It *is* Being as the everlasting, constant and necessary concentrate of immutability, unity, completeness, coherence, perfection and definiteness.

ZENO

"Controversy" fits current literature on Zeno every bit as well as it did studies on Pythagoras and on Parmenides, except here a third kind of scholar enters the lists. Not only philologists and philosophers but mathematicians too are taken up with Zeno's paradoxes. The outcome is (to quote Guthrie again – vol. I, p. 146, n. 1) a "bottomless pit" of publications or, to change to a figure suggested by N. B. Booth with Zeno himself in mind, "a fog [which] the incessant labours of modern scholars often cause . . . to descend upon our understanding."¹⁴⁵ However foggy the intellectual

¹⁴⁴ As we noted *supra* in our "Introduction," Mondolfo, following G. Calogero (*Studi sull' eleatismo* [Roma: Tipografia del Senato, 1932]), would disagree. In his interpretation not only does Parmenides view Being as temporally infinite in its transcendence of time and succession (see pp. 91-97). He also considers Being to be a spatially infinite sphere (pp. 363-72). Xenophanes had anticipated Parmenides in this notion with *una sfera infinita, estensione illimitata di spazio e materia* (pp. 360-61) and Empedocles would follow him (pp. 367-69). Parmenidean Being is dynamic (vs. Melissus' static conception – see pp. 373, 382) since his sphere was not enclosed within a set circumference which would exclude further extension but it could expand equally in every direction: *ma in quanto uguale possibilità di estensione in ogni direzione: uguale lungo qualsiasi raggio tracciato dal centro nei confronti con qualsiasi altro raggio; ma uguale anche in qualsiasi punto di ogni singolo raggio nei confronti con qualsiasi altro punto del raggio medesimo* (p. 364). Yet this spherical infinity does not neutralize Being's limit (pp. 95-96, 367). Also see Guazzoni Foà, "Dall'*apeiron*," pp. 471-73; *idem*, "Un ripensamento sulla *sphaira* di Parmenide," *GM*, 21 (1966), 344-54; T. G. Sinnige, pp. 29-48, 85-86, for whom Parmenides expresses by *ateleston* (Fr. 8, 4) what Anaximander intends by *apeiron*: reality extends indefinitely, is spatially unbounded (pp. 44, 46). But see references to H. Fränkel *supra*, n. 136.

¹⁴⁵ "Zeno's Paradoxes," *JHS*, 77 (1957), 187; also see T. G. Sinnige, pp. 91-92.

atmosphere may be, though, there emerges from modern scholarship a sufficiently clear view of various attitudes taken on Zeno's texts. Up to the second half of the nineteenth century students of Greek philosophy considered Aristotle's (and Simplicius') accounts of Zeno to be basically accurate. Accordingly, they thought of Zeno as Parmenides' faithful disciple, intent on defending his master by arguing that the plurality and motion which his adversaries championed led to absurdities. Following Aristotle's lead, they viewed Zeno's arguments as fallacies and "during these many centuries the efforts of philosophers and mathematicians... were to explain the exact nature of Zeno's blunders."¹⁴⁶

But in 1885 and thereafter Paul Tannery and other Frenchmen advanced the theory that "Zeno must have been more intelligent than Aristotle made him out to be"¹⁴⁷ and, hence, the Stagirite incompletely and incorrectly reported him. "His arguments were turned away from their true purpose by the Sophists who used them in advancing scepticism and the denial of knowledge, and... Aristotle reported them as modified by the Sophists." Consequently, Zeno did not wish to exclude motion from reality (his arguments on motion are judged by Bertrand Russell to be "all immeasurably subtle and profound")¹⁴⁸ but only to show that it "was impossible under the conception of space as the sum of points."¹⁴⁹

A reaction to the French exegesis has set in among some philologists and philosophers, initiated by G. Calogero in 1932 and vigorously renewed by N. B. Booth in the article already cited.¹⁵⁰ Mathematicians, though, have tended to welcome the French interpretation wholeheartedly under the impetus of discoveries in modern mathematics by Richard Dedekind and Georg Cantor.¹⁵¹ In fact, they view Zeno's arguments as calling for such discoveries. The full and correct explanation of his paradoxes, as

¹⁴⁶ Florian Cajori, "The History of Zeno's Arguments on Motion," *American Mathematical Monthly*, 22 (1915), 3.

¹⁴⁷ N. Booth, "Zeno's Paradoxes," p. 187. Booth mentions the following besides Tannery: V. Brochard (1893), G. Noel (1893); F. Cajori, "The History," p. 3 mentions also V. Cousin (1865) and G. Grote (1875).

¹⁴⁸ *The Principles of Mathematics* (New York: W. W. Norton and Company, Inc., [2nd ed.] 1937), p. 347.

¹⁴⁹ F. Cajori, "The History," p. 3.

¹⁵⁰ See above, n. 145. Nuances in this reaction are indicated by G, vol. II, 83-85; G. Vlastos, "Zeno of Elea," *EP*, 8 (1967), 376-78.

¹⁵¹ See F. Cajori, "The History," pp. 215-20, 253-58. Actually, the mathematical discoveries preceded the French exegesis to some extent. Dedekind published his discoveries in 1872 and 1888, Cantor in 1883 (see F. Cajori, *ibid.*, p. 216). Paul Tannery, whom Cajori (p. 255) lists as a mathematician and as a "noted historian of mathematics," published his significantly entitled article, "Le concept scientifique du continu. Zénon d'Elée et Georg Cantor," in 1885 in *Revue philosophique de la France et de l'étranger*, vol. 20, pp. 385-410.

Cajori informs us, "requires two ideas which are very familiar to the modern mathematician, namely, the acceptance of the existence of actually infinite aggregates and the idea of a connected and perfect continuum."¹⁵² Granted, the Zenonian question "is still regarded as being in an unsettled condition." But such disquiet is abroad only because "philosophers whose intellectual interests are remote from mathematics are taking little interest in the linear continuum as created by the school of Georg Cantor.... Cantor and his followers are willing to assume a continuum which transcends sensuous intuition." Current perplexities would vanish if only philosophers would show the same willingness, if only they would "examine with proper care the massive creation by our great mathematicians, without which the tiniest quiver of a leaf on a tree remains incomprehensible" (*ibid.*, p. 297).

Lack of time, talent and training prevent our carrying out Cajori's fervorino on any large scale. But we shall briefly review a study which is underpinned by modern mathematics: Harold N. Lee, "Are Zeno's Paradoxes Based on a Mistake?" *Mind*, 74 (1966), 563-70. This will be preceded, however, by an examination of a philosophical essay: Jesse De Boer, "A Critique of Continuity, Infinity, and Allied Concepts in the Natural Philosophy of Bergson and Russell," in *Return to Reason: Essays in Realistic Philosophy*, ed. John Wild (Chicago: Henry Regnery Company, 1953), pp. 92-124.¹⁵³

Jesse De Boer

Attempting to synopsise the article of this American scholar is difficult because of its complexity. He aims at setting forth "certain basic concepts in natural philosophy" by first charting the conflict between the answers Henri Bergson and Bertrand Russell gave to Zeno's paradoxes – a conflict which centers on such crucial topics as change, continuity, space, time, infinity (p. 94).¹⁵⁴ Let us begin with that chart and then move on to De Boer's own reply to Zeno.

¹⁵² F. Cajori, *ibid.*, p. 215. Also see W. C. Salmon, *Zeno's Paradoxes* (Indianapolis: Bobbs-Merrill, 1970), esp. pp. 16-44, which give references to relevant articles Salmon reproduces.

¹⁵³ De Boer's article is studied prior to Lee's because it chronologically appeared first. Neither article is listed by G, vol. II, 85-86, the former possibly because of its appearance in a volume of nonphilological essays, the latter because of its date of publication.

¹⁵⁴ For a general knowledge of the content of Zeno's four paradoxes (which De Boer presupposes), see N. Booth, "Zeno's Paradoxes," pp. 188-96; R. S. Brumbaugh, *The Philosophers of Greece* (New York: Thomas Y. Crowell Company,

According to De Boer's well documented account, Bergson countered Zeno's thrust partly by replacing intellect with intuition as the apt means for successfully coping with change. Intellect represents change not as it really is but "as a series of discrete forms plus indeterminate becoming" (p. 94). It thus reduces "motion to immobilities, it functions in the manner of a cinematograph... [by taking] a series of static snapshots of [for example] the marching regiment," to which it adds a characterless, general becoming. "What has been lost in this procedure is the essence of change: the individuality of each concrete process, and its continuity, that is, its indivisibility and mobility" (pp. 97-98). Intuition is free of such charges because of its direct insight into change as change. It thus preserves concrete processes in their individuality and continuity.

Another countermeasure Bergson used was to exclude "forms," "things," "essences," "states" (they are all synonymous) from reality. "They are merely mental snapshots, instantaneous cuts made by the mind in flux. If they were taken as real, thought would represent a change as composed of them, as a multiplicity of stable entities. This is completely wrong" (p. 96). Only change is real and this fact decides all else. "Since change is indubitable, and to be a thing is to be static, there is no thing. Change is ultimate; things are nonexistent... [Bergson himself:] 'There are changes, but there are underneath the change no things which change; change has no need of a support. There are movements, but there is no inert or invariable object which moves: movement does not imply a mobile' [*Creative Mind*, p. 173]" (pp. 95-96).

What, more exactly, is change? Change or motion or duration or time (the words can be interchanged with little or no difference in meaning) is continuous and indivisible. Its "parts" are not juxtaposed but interpenetrate and fuse. It is "a succession without distinction." It is not subject to mathematics, to numeration or measurement; to proceed as if it is, is to spatialize it.¹⁵⁵ Moreover, "time or duration is intuited in self-knowledge;

1964), pp. 59-67; G, vol. II, 91-95; A. Ushenko, "Zeno's Paradoxes," *Mind*, 55 (1946), 151-65; T. G. Sinnige, pp. 89-101; KR 291-97; H. D. P. Lee, *Zeno of Elea* (Cambridge: University Press, 1936), 17-36. The last two scholars give the Greek text. All give a translation or commentary for each of the paradoxes, which are commonly called Dichotomy, Achilles, Arrow and Stadium. Also see H. Fränkel, *Wege und Formen*, pp. 198-236; G. Ryle, *Dilemmas* (Cambridge: University Press, 1954), pp. 36-53 ("Achilles and the Tortoise"); A. A. Chrosara, "Analisi di un sofisma quantitativo: L'Achilles... secondo Zenone di Elea," *Angelicum*, 44 (1967), 315-38; G. Calogero, "Paradoxes logiques et réalité dialogique," *BSPH*, 60 (1966), 37-38; W. C. Salmon, *Zeno's Paradoxes*, pp. 8-16.

¹⁵⁵ Bergson gives "space" a pejorative meaning. De Boer, p. 98: "Space is the perfect achievement by intellect of its ideal of dividing a continuum into static factors, each separate from the others in location and causal efficacy. Etc."

in the present phase of the self, past phases are present as ingredients in an expanding unity. Motion cannot occur in space, for its parts are separate positions. Motion depends on synthesis of positions, and this can occur only in duration, which is consciousness... [Bergson:] 'Duration and motion are mental syntheses' [*Time and Free Will*, p. 120]" (p. 98). In summary, then, motion or time is a continuum which is successive but not divisible into static or formal factors (such as positions or instants) and which is basically consciousness itself.

This view of motion grounds Bergson's decision that all Zeno's paradoxes are due to an illusion and all embody a confusion.

The confusion is between two things: the act of motion, which is continuous, undivided, indivisible; and the path it traverses, which is "homogeneous quantity" and is therefore multiple, discontinuous, divisible, and actually divided into an infinity of parts in juxtaposition. If we fall into this confusion, we shall embrace the illusion that a motion can be "applied to" the line it traces in space, that what is true of the path will be true of the motion also (p. 99).

Bertrand Russell opposes the French philosopher at almost every turn.¹⁵⁶ Intellect, especially if it belongs to a mathematician, is perfectly capable of coping with change. As mathematically conceived, change is a series of states. If this conception is cinematographic, then so be it: a cinematograph, properly understood, will competently represent a continuous motion (p. 103). Any motion is a series of pictures, and continuous motion is "an infinite number of pictures no two of which are next or successive" (p. 103).¹⁵⁷

The British philosopher retains "things" also. If one should consider Parmenides to have said there are things but no changes and Bergson to say there are changes but no things, then Russell would say there are both things and changes (p. 103). He gives those words his own meaning, though. Mathematically interpreted, a "thing" is a "construction based on the notion of an infinite set of perceptual perspectives, or an element entering... into an infinite set of relations" (p. 104). And "change"? It does not involve "the presence in the thing of 'some internal state of

¹⁵⁶ See his *History of Western Philosophy* (London: George Allen and Unwin Ltd., 1961), pp. 756-65; *Our Knowledge of the External World* (London: George Allen and Unwin Ltd., 1961), *passim* (see Index).

¹⁵⁷ De Boer (p. 114) sets up an interesting contrast between Russell and Bergson *re* the cinematograph. Accurately understood, this "mechanism when operating consists of two ingredients: the series of snapshots... and also motion or process" through the turning of the reel. According to Russell, motion is a series of pictures "but the mechanism is not turning." Bergson has the mechanism turning "but he talks as if the pictures are of nothing at all."

change' [as though] the thing must, at each instant, be intrinsically different from what it would be if it were not changing" (p. 103). No, change or motion simply implies relations. Change is a thing in ever differing relationships from its being in different places (here and there) at different times (earlier and later; p. 104). Also, change is a continuum: a series of formal factors which are compact (i.e., no two are consecutive but between any two there are others; p. 107). This analysis into formal elements (positions for motion, durationless instants for time, points for space) does not destroy continuity: motion, time and space are, in fact, series of just such items (p. 105). Why so? Because there are infinite numbers and this because there are fractions. "There are fractions; there is such a series as all the fractions less than 1 ordered by decreasing magnitude; therefore, there are infinite numbers. Hence a continuum is a compact series of formal factors" (p. 107).

Escape from Zeno's ingenious arguments, Russell figures, is then secured neither by abandoning motion, space and time (as did Parmenides and Zeno himself) nor by judging a continuum to be indivisible (as did Bergson) but by realizing that a continuum is divisible into an actually infinite number of formal factors (p. 107).¹⁵⁸

In setting forth his own theory, De Boer refuses all three roads of escape. He reaffirms the reality of motion, decides a continuum is divisible, allows it only potential infinity.

"Is Bergson right," De Boer asks, "in believing that the use of formal factors in analyzing change reduces it to states?" Not at all, he replies. "To recognize the continuity of a motion is to recognize that it is one unbroken motion, which, since it is a transition from one place to another, can be divided (conceptually) *into* halves, the halves into quarters, and so forth" (p. 111). But this intellectual division does not transform the change into states. "The change is from one mode of definiteness to another, along a path traced by the changing thing: this path can be divided *ad infinitum*, and the division is never *into* forms [i.e., positions, points] but *at* forms *into* continuous components of the continua involved in change. And since the forms and the components they divide are not actual or distinct in the motion, though they are mentally *distinguishable* or *realizable*, they do not break the continuity of the motion" (p. 112).

As De Boer evaluates the situation, Bergson over-reacts to Russell by denying the reality of formal factors altogether and thus excludes from a

¹⁵⁸ According to De Boer, Russell's theory on actual infinity is not convincing. His definition of infinite numbers not only does not correspond with physical fact: it does not correspond to mental actualization either. See pp. 108-109.

continuum both division and divisibility. But divisibility is not identical with actual division into an infinity of positions and, hence, can be retained. "To be *divisible* is not to be *divided*; and what we *can* divide the motion *into* is not stops but partial motions, though we do [mentally] divide it *at* the stops." Consequently,

A continuous motion is one motion; the moving body passes without stopping from the position (a form) it occupied before moving to the position at which its motion terminates in rest. If the motion were actually divided, it would no longer be one motion – it would be broken by rest, which is to occupy the same position for a time. This, the one motion does not do, but it *can be* divided by us at any number of positions discriminable in its path. The positions are points at which the moving body might have stopped but did not, and so are not actual in the motion; we are able to actualize them mentally, however, and thereby to analyze the motion and specify its structure

[Hence] mental actualization of what is potential in a motion does not falsify; it does not divide the motion. but defines it. The intellectual analysis is not artificial; it diagrams the motion precisely. The divisions are "mental snapshots," indeed, but these are exactly what is needed to understand the motion, to convert it from a fact which is broadly and vaguely apprehended to one which is precisely determined, made as clear-cut as we can make it Since the snapshots are known to be not the parts of motion but the formal factors really potential in it, they do not convert mobility into immobility (pp. 112-13).

Our justification for such a long quotation is that it expresses the main points of De Boer's position. What remains is for him to acknowledge it basically as Aristotle's (p. 121) and to apply it to Zeno's paradoxes. Although these are not all based on a single confusion (vs. Bergson), yet "they are all answerable by a single proposition . . . [namely,] that space, time and motion are each continuous" (p. 119). And what is a continuum? A whole definable as containing parts which are not actually distinct and which are the same in kind as the whole, themselves continuous and each continuous with others (p. 120).

Let us rapidly look at each paradox in the light of that proposition and definition. "The dichotomy and the Achilles alike contend that the infinity of points in the space traversed by a moving body prevents its being crossed in a finite time" (p. 119). Answer: infinity of space and time is only "the potential infinity of divisibility," whereas the space and time Achilles has to cross are actually finite and, hence, he has no difficulty in overtaking the tortoise (pp. 119-20). The arrow- and stadium-paradox are answered in a similar way.¹⁵⁹ Zeno assumed that time, space and

¹⁵⁹ For special complexity in the third paradox, see p. 120: Aristotle's text itself does not make clear whether Zeno conceived the indivisibles of which time is composed as times or instants or how he represented their number.

motion are divisible into infinitesimals – i.e., least times, least spaces, least motions, all of which are indivisible. This assumption excludes difference in velocity. But neither time nor space nor motion consists of ultimate indivisible parts but is continuous and infinitely (but only potentially) divisible. Hence, the paradoxes collapse (p. 120; see p. 117).¹⁶⁰

Harold N. Lee

Despite its brevity Lee's article, "Are Zeno's Paradoxes Based on a Mistake?" is ambitious.¹⁶¹ It claims to show that the problem the Greek philosopher raised "is not a rational problem at all because its very statement involves a confusion" (p. 563). While making good that claim, he also points out that Aristotle's answer by distinguishing between two kinds of infinity "is of no help" (p. 564). Even Bertrand Russell is judged to have "led astray a whole generation of philosophers" by basing his reply upon a pseudo-continuum – a continuity characterized by compactness (p. 568).

What is Lee's own approach to the paradoxes? He uses a logico-mathematical theory (p. 568) based upon Richard Dedekind's definition of irrational numbers and Georg Cantor's demonstration that the series of real numbers (both rationals and irrationals) constitutes a linear continuum (p. 569). The nub of his theory is that there are two sorts of infinity, one of which is a dense series of rational numbers, the other a continuous series of both rational and irrational numbers. The first series is "dense" in that between every two of its elements (= numbers) there is always another element.¹⁶² Its elements are discrete and also denumerable – that is, "they can be put into one-to-one correspondence with the series of positive integers" (p. 566). Its cardinal number "is the first (least inclusive) transfinite number . . . [which Cantor] called . . . aleph-sub-zero" (p. 567). On the other hand, a continuous series is neither discrete nor denumerable. Its cardinal number "is the second transfinite and is either aleph-sub-one or 2 to the aleph-sub-zero-power" (*ibid.*).

In formulating his first two paradoxes (the only ones, incidentally, which Lee explicitly treats), Zeno failed to discriminate between those two in-

¹⁶⁰ For a position similar to and influenced by De Boer, see James F. O'Brien, "Zeno's Paradoxes of Motion," *TMS*, 40 (1963), 105-138.

¹⁶¹ *Mind*, 74 (1966), 563-70.

¹⁶² "Dense" is a translation of G. Cantor's *überall dicht*. Bertrand Russell translates it as "compact." See E. V. Huntington, *The Continuum and Other Types of Serial Order* (Cambridge, Mass.: Harvard U. Press, 1929), p. 34, note.

finities and used in his analysis solely that of a dense series.¹⁶³ In short, "he used the model of a pseudo-continuum" (p. 567) by analyzing motion "in terms of a rational series only; that is by infinite divisibility into rational fractions." That is to say,

In the Dichotomy, the series is generated from the familiar $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, . . . In the Achilles, the series is generated from fractions that vary according to the relative speeds of the runners, but how far Achilles must go before reaching the place where the tortoise was is always a rational fraction of how far he had to go the previous time, and how far the tortoise is ahead at any stated time is a rational fraction of how far he was ahead the previous time. The rational fractions make up a denumerable, dense series, and there are gaps in such a series, gaps that cannot be completely filled by other rational fractions no matter how small the gaps and no matter if there is an infinity of rational fractions (p. 565).

Because of those gaps, because irrational numbers are left out, a dense series is discrete, not continuous. But "motion requires continuous space and time . . . [Hence,] if Zeno's way of putting the argument is granted, Achilles cannot overtake the tortoise. Achilles does overtake the tortoise, however, and a contradiction seems to be set up between the rational conditions and the actual event" (pp. 563-64).

The contradiction was broken when "Dedekind showed 'that there exist infinitely many cuts not produced by rational numbers' (rational fractions), and gave a general formula for such cuts . . . Dedekind cuts will produce the series of real numbers, including both the rationals and the irrationals. The series of reals is a linear continuum" (pp. 564-65).¹⁶⁴ Such continuity permits motion and the paradoxes vanish.

Zeno, however, was unaware of a linear continuum and, hence, analyzed motion incorrectly. But his "analysis was not incorrect in the sense of being totally wrong . . . [but] only of being incomplete" (p. 569). This incompleteness, together with the confusion it generated, could not be precisely pointed out until the last decades of the nineteenth century. Do his paradoxes, then, display nothing of philosophic importance? On the contrary, they "illustrate a principle of great importance. They showed in

¹⁶³ Aristotle also was unaware of any such discrimination (p. 564), whereas B. Russell failed by linking continuity with a "dense" or "compact" series (p. 568). On Russell, also see V. C. Chappell, "Time and Zeno's Arrow," *JP*, 59 (1962), 207; J. Thomson, "Infinity in Mathematics and Logic," *EP*, IV (1967), 187-89.

¹⁶⁴ Lee takes his definition of "cut" (Dedekind's German word was *Schnitt*) from E. V. Huntington, *Continuum*, p. 54, note: "A cut is simply a rule for dividing a series K into two non-empty parts K_1 and K_2 , such that every element of K_1 precedes every element of K_2 , while K_1 and K_2 together exhaust the series K ." Dedekind's own explanation is found in *Essays on the Theory of Numbers*, transl. W. W. Beman. (La Salle, Illinois: Open Court Publishing Co., 1948), pp. 12-13.

a spectacular way 2,300 years before Dedekind and Cantor that continuity cannot be composed of discrete elements even if there is an infinity of them. Not only can continuity not be composed of discrete elements, but it cannot be rendered intelligible by analysis into discrete units" (*ibid.*).¹⁶⁵

Conclusions

Lee's insight that "continuity cannot be composed of discrete elements even if there is an infinity of them" is both important and valid provided "discrete" is accurately interpreted as "actually distinct, actually divided." Obviously, actual division eliminates continuity by severing quantity, motion and time into a definite number of sections, each of them distinct from what precedes and follows it. But "actual division" is not identical with "potential division," nor "divided" with "divisible" nor "discrete" with "discernible," as De Boer made clear above. Now, an unbroken stretch of quantity, as well as the motion of a body traversing it and the time measuring the motion, is not divided but only is divisible (this because by its very nature it potentially involves parts). Hence, such quantity, motion and time are genuine continua and the paradoxical dimensions in Zeno's arguments disappear.

What, then, is a continuum? Aristotle's definition, which Lee reported but set aside (pp. 564, 567), is as accurate as any and should be re-instated. A continuum is whatever has infinitely divisible parts in such fashion that any two parts actually have a boundary in common.¹⁶⁶

Aristotle's theory of infinity, which Lee also mentions but refuses (p. 564), should be re-affirmed too. Although we shall be concerned with it at length in a subsequent volume, let us outline it here, since Zeno certainly helped push Aristotle into elaborating it and since it apparently

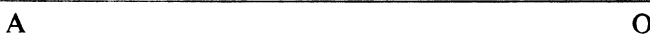
¹⁶⁵ For an approach similar to Lee's, see T. G. Sinnige, pp. 94-97; also Lawrence J. Pozsgay, "Zeno's Achilles Paradox," *TMS*, 43 (1966), 375-95. Pozsgay utilizes Frege, Cantor and other modern mathematicians to interpret the paradoxes (pp. 375-85). He refuses Aristotelian conceptions of act-potency as solutions (pp. 385-95). For a reaction see Michel Stogre, "Mathematics and the Paradoxes of Zeno: A Rejoinder to L. Pozsgay," *TMS*, 45 (1968), 313-19.

¹⁶⁶ For Aristotle's theory on continuum see *Physics*, 227a10-16, 231b10 sq., 232b25; *Categories*, 205a1-14.

Reinstatement of Aristotle does not necessarily exclude mathematical definitions of continuity, which can be valid and helpful mathematically but which are not directly applicable to actual motion and other continua in the physical universe (vs. B. Russell, *Our Knowledge*, pp. 137, 138-40). For Dedekind's definition of continuity, see *Essays on Theory of Numbers*, p. 11. For B. Russell's emendation, see *Principles of Mathematics*, pp. 279-80.

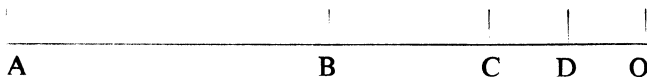
coincides with the *apeiria* which Zeno himself had in mind in his paradoxes and especially in his arguments against plurality (Fragments 1 and 3).

According to Aristotle, infinity can be a characteristic of quantity, motion and time.¹⁶⁷ It belongs to the latter two, though, because of their relationship with the former: motion is infinite if the magnitude covered is somehow infinite and time is so only as a measure of an infinite motion. What, then, is *apeiria* as found in quantity? Basically it has to do with certain conditions of a line. Let AO be an actual line of definite length.



Points terminate it at beginning and end and, thus, such a line is finite. Because of its definite dimensions, it can be measured, known and described. Its extension is related to the terminating points in somewhat the same way as matter to form, and it is itself a composite, so to speak, of matter and form. Since perfection and actuality, no less than intelligibility, arise from the presence of form, AO is not only knowable but is perfect and actual as well. Consequently, the condition of finiteness in AO arises from its possession of definite dimensions and is aligned with perfection, actuality and knowledge.

But how is AO infinite? If AO is finite insofar as it has definite dimensions because of its initial and final terminating points, it is infinite inasmuch as it can be conceived without one or other of those terminations. Thus AO is infinite with respect to increase inasmuch as, no matter what its actual length may be, one can always imagine it as without its final point and thus as extending further. AO is also infinite with respect to decrease under certain conditions — no matter how small it actually becomes by its initial point receding towards its final one, one can always conceive it as smaller, provided that the recession through subtraction of parts takes place according to a fixed ratio. Thus, let AO be divided at B, C, D, etc. so that $AB = \frac{1}{2} AO$, $BC = \frac{1}{2} BO$, $CD = \frac{1}{2} CO$, and so on.



The subtraction of AB, BC, etc. from AO can go on forever and some

¹⁶⁷ The explanation in this and the next two paragraphs is taken almost *verbatim* from L. Sweeney, S.J., "Infinity," *NCE*, VII, 505. Aristotle develops his theory mainly in *Physics* Book III, chs. 4-8; Book VI, ch. 7. Also see Kurt von Fritz, "Das *Apeiron* bei Aristoteles," *Naturphilosophie bei Aristoteles und Theophrast* Heidelberg: Lothar Stiehm, 1969), pp. 65-84; J. Hintikka, "Aristotelian Infinity," *PR*, 75 (1966), 197-218.

of AO will always be left. No matter how small that remaining part becomes, one can conceive of it as still smaller because it too is similarly divisible. Consequently, AO is thus infinite with respect to decrease when viewed without the initial point it actually has.

With what characteristics is such infinity connected? Finitude is, as previously suggested, linked with intelligibility, actuality and perfection because extension in a finite line is related to its terminal points as matter and form. On the other hand, a line is infinite when its extension is viewed as lacking either its initial or final points, and, thus, infinity indicates that a line in such a condition is like matter without form. But form is the source of knowableness, actuality and perfection. Accordingly, infinity is linked with a state of unintelligibility, mere potentiality and imperfection. An infinite line is, precisely as infinite, unknowable because it lacks definite dimensions and, thus, cannot be measured or described. Its infinity is merely a potential condition since every line is actually finite because of its definite length, though it can be considered as subjected to an endless process of addition or of division because of the very nature of quantity. An infinite line is imperfect because it is viewed as lacking the determinate dimensions it should and actually does have.

Such is the doctrine of infinity which Aristotle worked out at least partially in order to reply to Zeno.¹⁶⁸ If it is an accurate response, it is also the notion of infinity which Zeno's arguments called for and, apparently, which he himself had in mind to some degree. This is suggested by his statement in the Dichotomy paradox that "that which is in locomotion must arrive at the halfway stage before it arrives at the goal" [KR 292].¹⁶⁹ It is especially evident in his two demonstrations against plurality.

¹⁶⁸ On Zeno's influence on Aristotle, see G. Vlastos, "Zeno," *EP*, VIII, 377: In discussing Zeno's argumentations "Aristotle presents his own theory of the potential infinite as the answer. Since he does not offer any hint of a possible solution along alternative lines, it may well be that Zenonian paradoxes helped convince him that only by the denial of the actual infinite could infinite divisibility be freed from contradiction." For an application of Aristotle's doctrine to the Paradoxes, see De Boer, pp. 119-20 (paraphrased above). For Zeno's influence on Aristotle's theory of dynamics, see G. E. L. Owen, "Zeno and the Mathematicians," in W. C. Salmon, *Zeno's Paradoxes*, pp. 156-63.

¹⁶⁹ See G, vol. II, 91-92: according to Zeno "motion is impossible because an object moving between any two points *A* and *B* must always cover half the distance before it gets to the end. But before covering half the distance it must cover the half of the half, and so *ad infinitum*. Thus to traverse any distance at all it must cover an infinite number of points, which is impossible in any finite time." On the difference between the Dichotomy and Achilles arguments, see A. Harrison, "Zeno's Paper Chase," *Mind*, 76 (1967), 568-75; T. G. Sinnige, pp. 89-97.

Multiplicity, he reasons in Fragment 3, will entail that things are finitely many (*peperasmena*): the number of existents making up the whole of the universe must be finite since they are only as many as they actually are. But they are also "infinite[ly many]. For there are always other [existents] between existents, and again others between these. And thus the existents are infinite[ly many]." ¹⁷⁰ In another argumentation (Fr. 1), he endeavors to show that plurality leads to the absurd conclusion that things simultaneously are so small as to have no magnitude and so great as to be infinite (*μεγάλα δὲ ὥστε ἄπειρα εἶναι*). In developing the last point he states that "each [existent] must have some size and bulk and some [part of each] must lie beyond another [part of the same existent]. And the same reasoning holds of the projecting [part]: for this too will have some size and some [part] of it will project. Now to say this once is as good as saying it forever. For no such [part – that is, no part resulting from this continuing subdivision] will be the last nor will one [part] ever exist not [similarly] related to [that is, projecting from] another." ¹⁷¹

Granted, none of those three references indicate that Zeno is explicitly aware of Aristotle's linking finiteness with form and infinitude with matter nor of his contrasting potential with actual infinity. But all of them do suggest that Zeno realized these notions basic to Aristotle's view: division and addition as endless processes. No matter how small a part one's dividing a quantity according to a fixed ratio may actually have produced, one can always imagine it as divided smaller still: this insight is back of the Dichotomy paradox. One's covering the complete distance between start and goal can occur only after one travels half the distance, an occurrence which is possible only when one travels one-fourth the distance, and so on *ad infinitum* (see above, note 169). On the other hand, no matter how large a sum one achieves by addition, one can always imagine it larger still – an insight which underlies both Fragments. The nerve of Fr. 3 is that given (say) three existents, "there must be at least two more (a fourth between first and second, a fifth between the second and third) and so, generally, if there are n existents, there must be at least $n-1$ more." ¹⁷² According to Fr. 1, a single thing having depth consists of

¹⁷⁰ G. Vlastos's translation, *EP*, VIII, 371. The Greek of the last sentence: καὶ οὕτως ἄπειρα τὰ ὄντα ἐστί.

¹⁷¹ G. Vlastos's translation, *ibid.*, p. 370. For G. E. L. Owen's translation, see "Zeno and Mathematicians," pp. 142-43. Owens fits the paradoxes of motion and of plurality into one coherent pattern (see *ibid.*, pp. 140-56).

¹⁷² G. Vlastos, *EP*, p. 371. Also see Herman Fränkel, "Zeno of Elea's Attacks on Plurality," *AJP*, 63 (1942), 5: "If we assume plurality, i.e., divisibility of any unit, some part of it is here and some other part is there. But even if Here and

opposite sides (top and bottom, front and back), which are distant from one another. The front (or any other side) also has magnitude and thus would have its own front and back. These latter, also, would each have a front and back and so on indefinitely, with the result that "we never can reach an ultimate surface to limit the extension of a body Thus, in trying to measure the thickness of an object, we have the perplexing experience of finding that something always remains to be added to it, and the object seems to expand without end."¹⁷³

However clumsily Zeno may have expressed himself in Fragment 1, still it seems clear that what he said there, as well as in Fragment 3 and the Dichotomy paradox, summoned and even anticipated the Aristotelian conception of infinity in some of its fundamental traits. If so, that anticipation is a major source of irony and (if you will) of paradox in Zeno's career. In Parmenides' intellection of Being, *peras* held a place of honor. Limit *is* Being in its immutability, unity, completeness, coherence, perfection and definiteness (see above, "Parmenides" section, last paragraph). In order to defend Parmenides' Being against those advocating movement and multiplicity, Zeno prepared argumentations designed to show that both change and plurality entail absurdities, contradictions, impossibilities.¹⁷⁴ Successful as they may have been as defence weapons, still they drew attention away from limit and focused it strongly on infinity. Thus they helped Aristotle and moderns develop doctrines of infinity. They may

There are very close together, nothing can prevent us from making the Something here and the Something there small enough to allow for a third thing to be squeezed in between them. The operation can be repeated indefinitely without reaching a limit." *Idem, Wege und Formen*, pp. 199-204.

¹⁷³ H. Fränkel, *AJP*, p. 196. See the entire section, pp. 193-97. Also see *idem, Wege und Formen*, pp. 210-32; G, vol. II, 89; W. A. Heidel, "The Pythagoreans and Greek Mathematics," 23-25; G. Vlastos, *PR*, 68 (1959), 533; *idem, Gnomon*, 31 (1959), 193-204; *idem*, "Zeno," *Philosophic Classics*, ed. W. Kaufmann (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., [2nd ed.] 1968), I, 22-28; D. J. Furley, pp. 64-69; F. Solmsen, *Aristotle's System*, p. 172 and n. 56; T. G. Sinnige, pp. 101-106.

¹⁷⁴ Juxtaposing Zeno with Parmenides is important. To appreciate what Zeno himself had in mind, one must "understand him in relation to his own times" (N. B. Booth, "Zeno's Paradoxes," p. 188). This understanding, in turn, leads us to "realize that Zeno's arguments were based ultimately on the dogma of Parmenides" (*ibid.*, p. 201). (For a contrasting attitude, see B. Russell, *Principles of Mathematics*, p. 348, note: "I pretend to no firsthand authority as to what Zeno really did say or mean . . . As they [Zeno's arguments] are, to me, merely a text for discussion, their historical correctness is of little importance.")

Who were the enemies of Parmenides whom Zeno opposed? According to Tannery, Cornford, Lee, Raven and others, they were principally the Pythagoreans, who "maintained that everything in the universe . . . was a sum of spatially extended units," equated with geometrical points (KR 290; see also G, vol. II, 89-91;

even have contained some of those doctrines in embryo.¹⁷⁵ Closer to home, they may be somewhat responsible for Melissus' joining spatial infinity to Eleatic Being. Of this we shall speak next.

MELISSUS

J. E. Raven starts his chapter on Melissus in *Pythagoreans and Eleatics* by complaining that this third Eleatic "has seldom received the attention that he both merits and fully repays" (p. 78) and J. H. M. M. Loenen observes that "generally speaking the study of Melissus has been unduly

T. G. Sinnige, pp. 40-48, 61, 88). But other scholars refuse this interpretation. For example, W. A. Heidel, "The Pythagoreans and Greek mathematics," p. 28: "We have no satisfactory evidence for the view that Zeno was attacking a particular theory, that is to say, the Pythagorean." Whom, then, did Zeno oppose? Mainly the ordinary man who unthinkingly accepts the multiplicity of nature. As N. Booth says ("Zeno's Paradoxes," p. 198), "Zeno's arguments would be directed. . . against the whole idea of a plurality of existing things." According to G. B. Kerferd, p. 137, this interpretation is beginning to win the day: "It is now widely supposed that Zeno was not in his paradoxes attacking any particular previous thinker, but rather all those who would not or had not given their assent to the basic Eleatic contentions about Being." See H. Fränkel, *Wege und Formen*, pp. 232-36. But see D. J. Furley, who grants the Pythagoreans were not Zeno's opponents (pp. 44-56) but puts Anaxagoras in their place: his theory of infinite divisibility of matter provoked Zeno's arguments (pp. 76-77; see below, note 227).

¹⁷⁵ Whether and to what extent Zeno may have been aware of those doctrines is difficult to determine. If an author is actually conscious of a theory but does not explicate it in statements which however do suggest it, then he may be said to imply it subjectively. But if he is entirely unaware of a theory, which however is somehow entailed in the very content of what he does say, he may be described as implying it objectively. If such a distinction between subjective and objective implication is valid, Zeno's arguments appear to have subjectively implied the Aristotelian position on infinity and continuum to the degree that he was aware of division and addition as each a limitless process. They may objectively have implied modern mathematical conceptions of infinity and continuum if the very data of the problems elaborated called for modern mathematics as one type of solution. In this minimal but apparently significant sense, the theories of Cantor, Dedekind and so on would to some extent be embedded in Zeno's statements, who thus implied them objectively. See B. Russell, *Our Knowledge*, pp. 175 and 183: "They are serious arguments, raising difficulties which it has taken two thousand years to answer . . . In some form [they] have afforded grounds for almost all the theories of space and time and infinity which have been constructed from his day to our own." For Zeno's relationship to modern mathematics, see Adolf Grünbaum, "Modern Science and Refutation of the Paradoxes of Zeno," *Scientific Monthly*, 81 (1955), 234-37; *idem*, *Philosophical Problems of Space and Time* (New York: Alfred A. Knopf, 1963), pp. 158-208; *idem*, *Modern Science and Zeno's Paradoxes* (Middleton, Conn.: Wesleyan University Press, 1967); T. Heath, I, 270-83; Mondolfo, pp. 237-49. But see T. G. Sinnige, pp. 129-37, on Anaxagoras as forerunner of Cantor and Bolzano.

neglected" (p. 125).¹⁷⁶ In the relatively rare investigations which have been made, though, his position turns out to be almost as controversial as those of his predecessors.¹⁷⁷

Fragment 9

Take as an example the various interpretations given Fragment 9: "If it [Being] is, it must be one; and being one, it must have no body (σῶμα μὴ ἔχειν). If it were to have bulk (εἰ δὲ ἔχοι πάχος), it would have parts and be no longer one" (KR 302). Burnet bluntly characterizes the statement as "incredible" (p. 327). Far from being incorporeal, reality "is a single, homogeneous, corporeal *plenum*, stretching out to infinity in space, and going backwards and forwards to infinity in time" (p. 326). Few other subsequent commentators side with Burnet. In *Pythagoreans and Eleatics* Raven grants that "in the time of Melissus the incorporeal was still unknown. The only way that any of the Eleatics could yet conceive of reality was as spatially extended" (p. 91). Nonetheless, reality was not "corporeal in the sense in which anything else is corporeal; it was emphatically not simply empty space; it was not extension in the ordinary sense, because it differed from ordinary extension in being indivisible." Yet it was not incorporeal, either. Its status could only be described as unique (*ibid.*). In his later book Raven seems to waver on his exclusion of empty space as a description: 'Melissus' own words allow no escape from the conclusion . . . [that he tended to think of reality as] empty space which is at once infinite in extent and yet has no 'body' or 'bulk' " and which must be conceived as having no parts. This is a decidedly awkward conception, but at least it shows Melissus to have been incapable "of imagining something that was not only incorporeal but non-spatial as well" (KR 304).¹⁷⁸

¹⁷⁶ Also see G. B. Kerferd, *APQ*, p. 138. Some consider this neglect to be justified. For example, Guthrie finds that Melissus' "preference is for explicit, pedestrian, and sometimes wearisomely repetitive argumentation" (vol. II, p. 103). Theodor Gomperz probably remains Melissus' harshest critic. See his *Greek Thinkers*, transl. L. Magnus (London: John Murray, 1920), vol. I, pp. 184-207. For a brief but helpful survey of Melissus, see D. J. Furley, "Melissus," *EP*, V, 264-65.

¹⁷⁷ With a few exceptions we shall restrict ourselves to the authors investigated in the "Parmenides" section above.

¹⁷⁸ N. B. Booth, "Did Melissus Believe in Incorporeal Being?" *AJP*, 79 (1958), 61-65, links Raven with G. Vlastos in such fashion that one might think both view Melissus' Being as strictly incorporeal (see especially pp. 61, 65). True, neither accepts Burnet's position. Yet, as our textual analysis has showed, Raven resists terming Being incorporeal. Vlastos offers no such resistance, as will be clear *infra*.

In his explanation of the Fragment, Guthrie experiences the same awkwardness. On the force of what *soma* means in philosophical contexts in the late fifth century, the British scholar concludes that "an entity can . . . be described as 'not having a *soma*' if it is intangible and invisible and has no boundaries (is *apeiron*)" and if it is without parts and, thereby, is indivisible (vol. II, 111). As without *pachos* ("thickness" or "bulk"), Being would be lacking density and rarity. Nevertheless, it is still spatial – in fact, it is infinitely extended in space and is completely full (p. 112), even though more likely than not Melissus thought of this ultimate reality as alive and divine by reason of a legacy from earlier thinkers (the Milesians, Pythagoreans, Heraclitus, Xenophanes; p. 114).¹⁷⁹

Loenen, even though he is inclined to understand Melissus (and also Parmenides) as having an awareness of God and, thus, a theology, refrains from affirming this theism because "we do not possess really conclusive evidence" (p. 176, n. 94). Sufficient evidence is at hand, though, for us to state that true being has "no body, no thickness, and no parts" (p. 174). But this statement does not imply that Melissus "may consciously have conceived it as a purely spiritual reality" (unlike Parmenides, whose Being was "a reality to which the categories of space and time fundamentally do not apply"). This implication is eliminated by the fact that true being is full and accordingly cannot move. Such fullness cannot be understood figuratively and, hence, "if he had consciously meant a spiritual being, he would not have given this argument. It would then have sufficed for him to state that it occupies no space and that locomotion is therefore fundamentally out of the question." How, then, should one depict true being? As "an incorporeal quantity, but it is not possible to say anything more precise about it. The tendency to conceive a purely incorporeal being is unmistakably present in Melissus, but he has not yet succeeded in arriving at the recognition that unity taken in an absolute sense is incompatible with succession in time and with a plurality of parts existing side by side (as the predicate full implies)." Melissus' arguments, Loenen admits, "cannot be freed from contradictions altogether" even in his interpretation (p. 175).

¹⁷⁹ Guthrie intimates Parmenides also viewed Being as alive and divine: "In the normal belief of early Greek thought the ultimately real is alive and divine. . . . It was so for Xenophanes, to whose one unmoving god Eleatic thought owed much of its inspiration. . . . Taking into account the theology of Parmenides' teacher Xenophanes . . . , it is more likely than not that he took for granted that reality was alive" (vol. II, p. 114). But if Parmenidean Being is alive and divine, how can Guthrie identify it with a geometrical sphere (see vol. II, p. 49, discussed *supra* "Parmenides" section). Surely, there is an inconsistency here.

While not classifying Melissus' statements as contradictory, J. Owens does grant that "it seems impossible to determine the exact meaning that Melissus gave to body and bulk in this contrast to the spatially extended plenum" (*Hist.*, p. 96). In order to escape divisibility into parts, Being must be without body and bulk. Yet Being is also "a plenum that is the opposite of a void." How achieve a "plenum without the divisibility into parts that goes with the notions of body and bulk?" Seemingly by simply postulating it: there must be "an extended plenum that nevertheless is neither body nor bulk" (p. 95). Beyond this postulate we meet a dead end: Melissus "attempted a solution through the exclusion of body and bulk from his conception of the extended plenum. But exactly how he separated the two notions of plenum and body from each other, cannot be determined from the fragment" (p. 96).

Towards the end of his article on Zeno in the *Encyclopedia of Philosophy* (VIII, 369-79), Gregory Vlastos discusses Zeno's influence upon other philosophers, one of whom was Melissus. "Incorporeality of Being," Vlastos states, "is never asserted by Parmenides, although his whole system cries out for such a doctrine; this we do find in Melissus." After quoting Fragment 9 of Melissus, he continues:

[This fragment is] a statement which it seems we have no choice but to take at face value But Zeno's book, written while he was still "a young man," must have preceded that of Melissus. Zeno must therefore be reckoned the first to make this doctrine explicit, as he undoubtedly does . . . in that first argument against plurality . . . that whatever has size is divisible into parts and hence cannot be one, since by "size" here he could only have meant three-dimensional extension, and it is impossible to see how he could have denied this to Being without also denying it material bulk (p. 377).

Melissus' Being is, then, strictly immaterial and Vlastos' position is in direct contrast to Burnet's.

Fragment 7

The second area of controversy can be surveyed more briefly since it is Loenen at odds with other exegetes. In Fragment 7, 7-10 Melissus attempts to demonstrate the immobility of Being from an absence of void. The question arises: from what is void absent? Loenen admits his answer is "more or less revolutionary" (p. 166): void is absent from true being itself. The grammatical subject of Fr. 7, 7 (οὐδε κενεόν ἔστιν οὐδέν) is true being and οὐδέν is taken in an adverbial sense, with this resultant translation: "Nor is it [true being] at all empty." Hence, "the meaning . . .

is undoubtedly: there does not exist a void within true being" (p. 163). His argumentation is a "rejection of 'partial' emptiness, of 'empty places' within infinite true being" (p. 165). Thus,

the logical coherence of the passage is perfectly transparent: "nor is it at all empty; for what is empty is nothing; (but) *that* (i.e. something that *is*) at any rate cannot be nothing." The reader will then supply without any difficulty the conclusion: consequently it (true being) is not empty at all. Melissus, however, does not care to say this explicitly and he immediately comes to his main conclusion: "it does not move" (p. 164).

But what of the physical world? How could this involve void if the void is nothing and, if no void, how is locomotion possible? Loenen's answer: "Melissus does not state . . . that the void does not exist at all He merely denies that there can be a void within true being, because *that* cannot be nothing, but this statement does not exclude the possibility that in the physical world he might assign reality to the void" (p. 165). We might assume him to have held with the Atomists that the void does exist. Consequently, "Melissus, while tacitly presupposing the reality of the concrete world, on the one hand does not consider it as full, but on the other hand not as absolutely empty either. In his view it must be a combination of empty and full, while one thing may be emptier or fuller than another. This implies the existence of the void within the physical world" and the possibility of local motion (p. 167).¹⁸⁰

In contrast with Loenen, other scholars view void as absent not from within but from outside Being. This absence, in fact, is one reason why Being is infinite, since "its limit [if it had one] would limit it against the void" (Aristotle, *De Generatione et Corruptione*, 325a14; KR 300). But there is no void; hence, Being is unlimited and, secondly, local motion too is impossible in the physical universe, which is unreal anyway.¹⁸¹

¹⁸⁰ Melissus' standpoint, Loenen grants, "amounts (at least implicitly and virtually) to a strict dualism between two kinds of reality, viz. the world of change, about which (unlike Parmenides) he does not speak any further . . . and absolute reality not perceptible by the senses" (p. 132; see also pp. 167-69). On perception of the senses, though, Loenen finds it "completely clear that Melissus by no means criticizes sense-perception as such" (p. 172).

¹⁸¹ See Burnet, p. 326; Raven, *PE*, 85-86; KR 300-302; G, vol. II, 104 and 107; Owens, *History*, pp. 93-94. Tarán's position is singular. He is vs. Loenen by not viewing void as excluded from within Being, by considering Melissus to have judged sense-knowledge to be deceitful and the phenomenal world to be unreal (pp. 78-80). Yet he differs from the others, too, by refusing to admit that the void-argument "was Melissus' reason for asserting infinity" or (vs. Raven) "that with this argument Melissus was correcting Parmenides who asserted that Being is limited on every side" (p. 154). On void in Parmenides, see these entries in Bibliography *infra*, Knight, Siegel.

Fragment 3

As a final instance of a controversial topic, let us consider infinity, which Melissus discusses in Fragments 2 to 6 (KR 299). At one extreme is Loenen again, who warns that τὸ μέγεθος ἄπειρον (Fr. 3), which flows from the fact that true being is infinite in time (p. 153), should not be taken spatially (p. 149, n. 41) but “in a qualitative sense. Thus the terms *megas* and *megathos* in Melissus refer to greatness or perfection.” There is no possibility in true being of “successive variations in perfection . . ., i.e. of the loss of old and the acquisition of new attributes” (p. 158). When understood qualitatively, “infinite in magnitude” is manifestly not inconsistent with true Being’s having no body or bulk (p. 175).¹⁸²

Tarán’s position is quite dissimilar to Loenen’s. The fact that Melissus asserted that Being is *apeiron* does not mean that his conception was different from Parmenides’. For both Parmenides and Melissus “Being is neither matter nor thought” (p. 201). What, then, does Melissus mean by *apeiron*? Basically the same as what Parmenides metaphorically signifies by *peras*: “that which exists must be undifferentiated” both spatially and temporally (pp. 153-54). “That Being is infinite means that it is homogeneous and therefore one” (p. 154).

Other exegetes differ from both Loenen and Tarán. Unlike the former, Burnet, Raven, Guthrie and Owens give “infinite in magnitude” of Fr. 3 some sort of quantitative sense. Unlike the latter, who understands it neither qualitatively nor quantitatively, they do not neutralize infinity by reducing it to the mere undifferentiation and homogeneity of a Being which is neither matter nor mind. However puzzling Melissus’ texts are, these scholars look on Being as somehow material – either something as gross as a corporeal plenum (Burnet) or as tenuous as empty space without parts (Raven), space extended and completely full yet intangible and without density (Guthrie), an indivisible plenum which is neither body nor bulk (Owens). This common view induces them to understand “infinity of

¹⁸² If Melissus lived centuries later and spoke of Being as “infinite in magnitude,” we might consider him to have meant the same as medieval authors by their “infinity of virtual quantity.” This was equivalent to “infinity of power” (*virtus*): God is so perfect as to be capable of lasting forever, of knowing and producing an endless series of effects, etc. (For a discussion, with references to texts in Augustine [in which the theory first appeared], Bonaventure, Aquinas, etc., see L. Sweeney, S. J., “Some Mediaeval Opponents of Divine Infinity,” *MS*, 19 [1957], especially pp. 234-37). But Melissus lived in the mid fifth century before Christ and such a sophisticated theory would appear beyond his grasp..

magnitude” as pointing somehow to Being’s limitless extension in space.¹⁸³ If one joins this endless spatial extension to the endless temporal duration of which Frs. 2 and 4 speak, one can detect what Melissus had in mind when he characterizes Being as *apeiron*.¹⁸⁴

Conclusions

In the preceding section an attempt was made to discuss some of the controversial topics in Melissus. Even though there are others,¹⁸⁵ still those investigated are sufficient to provide the context within which to develop our own interpretation of this Eleatic philosopher.

One thing is certain: in contrast to Parmenides (and also to Zeno if we can presume his positive although unexpressed doctrine agreed with the former’s), Melissus emphasized infinity. As poetically described by the first, Being is “motionless in the limits of mighty bonds” and, thus, “is without beginning and is never-ending” (Fr. 8, lines 26-27).¹⁸⁶ Why does Being abide so firmly where it is? Because “powerful Necessity holds it in the bonds of the limit which encircles Being, because it is not right for Being to be incomplete, for it is not in need” (lines 30-32). A bit later:

¹⁸³ See Burnet, pp. 325-26; KR 300-302; G, vol. II, 108-109; Owens, *History*, 92-93; D. J. Furley, pp. 28-61. If Melissus’ Being were spherical in shape (he does not indicate it is, though), it might be infinite as intraversable: one can travel around a sphere without ever coming to an end because it has none. It has a uniform surface with no terminations or unevenness to disrupt passage around it. See *infra* on Empedocles.

¹⁸⁴ G. Vlastos’s position on Fragment 3 would, it seems, come closest to Loenen’s, since he denies that “infinite in magnitude” means infinite in spatial extent. Its signification is rather “that of beginningless and endless duration” (*Gnomon* 25 [1953], 34). Obviously, Vlastos here abandons his own advice (*EP*, VIII, 377) of “taking at face value” Melissus’ Greek. Raven characterizes Vlastos’ position as “incredible” (KR 300, n. 2). Guthrie (vol. II, 100, n. 2) judges that “Vlastos’s normally acute reasoning is here fatally weakened.” N. B. Booth admits himself sceptical: “Vlastos’ arguments are forceful and well expressed, [but] they still fail to carry absolute conviction” (“Did Melissus,” p. 61). Also see G. B. Kerferd, p. 138.

¹⁸⁵ Another problem is how similar Melissus is to Parmenides. Tarán (pp. 154, 200) makes them practically identical. Loenen stresses their disparity *re* starting-points and methods (pp. 136-38, especially p. 141), immutability (p. 138), derivation of Being’s attributes (p. 143), meaning of “one” (p. 154), Being’s transcendence of space and time (pp. 174-75). The other scholars locate themselves between Tarán and Loenen by advocating that Melissus is basically like Parmenides but with differences (for references, see above, notes 181 and 183). For Mondolfo’s view, see pp. 95-99, 373-82.

¹⁸⁶ I am using Tarán’s translation of Fr. 8 and Greek text.

"Since there is a furthest limit, it [Being] is in every direction complete: like the body of a wellrounded sphere, from the middle everywhere of equal strength" (lines 42-44). None of this for Melissus, though. "Since it [Being] did not come into being, it is now, always was and always will be, without either beginning or end and [thus] is infinite" (Fr. 2: καὶ ἀρχὴν οὐκ ἔχει οὐδὲ τελευτήν, ἀλλ' ἄπειρόν ἐστιν).¹⁸⁷ Moreover, "just as it exists forever, so too it must forever be infinite in magnitude" (Fr. 3: τὸ μέγεθος ἄπειρον). Hence, "anything that has a beginning and an end is neither eternal nor infinite [spatially]" (Fr. 4: οὔτε αἰδίων οὔτε ἄπειρον). Finally, infinity eliminates plurality and ensures unicity: "For if Being were [infinite], it would be one; for if it were two, the two could not be infinite but would be limited by one another" (Fr. 6: οὐκ . . . ἄπειρα . . . ἀλλ' ἔχει ἄν πεῖρατα πρὸς ἀλλήλα).

Obviously, Melissus has substituted infinity for Parmenidean limit. How account for the substitution? Should one minimize its importance, as we have seen Tarán do by maintaining that Melissean *apeiria* and Parmenidean *peras* come to the same thing: Being's homogeneity and self-identity?¹⁸⁸ If such downplaying of importance is unsatisfactory, what can one say instead? There is no easy or simple reply.

First of all, Melissus appears to agree fundamentally with Parmenides in his central doctrines. True reality is motionless (Fr. 7, 7-10; Fr. 10), unique (Fragments 5-6), everlasting (Fragments 1, 2, 4) and complete (Fr. 2); hence, the physical world is unreal because it entails change, multiplicity, temporal succession and imperfection (Fr. 8).¹⁸⁹ True reality is known solely by intellection, whereas the phenomenal universe is the object of sense perception (Fr. 8). But then agreement vanishes: in Melissus' hand true reality becomes aligned with infinity rather than limit. If this new alignment is significant (vs. Tarán) and if it has not issued

¹⁸⁷ For this and subsequent translations in this paragraph, I am using (with slight modifications) Raven's in KR 299. On Fragments 2 to 7 see T. G. Sinnige, pp. 168-89; G. E. L. Owen, "Eleatic Questions," pp. 99-101.

¹⁸⁸ Tarán, pp. 153-54, 158, 200-201.

¹⁸⁹ I am giving textual references only to Melissus; for Parmenides' position see *supra*, "Parmenides" section. Despite their fundamental agreement in doctrine, Melissus' Being is everlastingly enduring in time, whereas Parmenides' Being is atemporally eternal: such at least is the view of Mondolfo, pp. 92-93 and C. H. Kahn, *Gnomon*, 40 (1968), 127-29. But Parmenides' denial of reality to temporal succession seems hardly equivalent to an affirmation of atemporal eternity. He appears rather to describe Being as an immutable concentrate of altogether-now-in-definite-presentness with no attempt at further specifying whether that all-at-once is atemporal or merely a changeless temporal *now*. See Mourelatos, pp. 103-110; G. E. L. Owen, "Plato and Parmenides on the Timeless Present," *Monist*, 50 (1966), 317-40.

from within the basic doctrines common to Melissus and Parmenides, what might be its origin? What extrinsic forces might have affected Melissus which Parmenides escaped? Possibly there are three: the attacks made on Eleatic theory by subsequent adversaries, the counterattacks launched by Zeno, and the Ionian milieu in which Melissus lived.

To start with the middle one: how may Zeno have influenced his fellow Eleatic? In this way, conceivably: by concentrating in his paradoxes and plurality-arguments on physical and spatial factors and on infinity,¹⁹⁰ he may have focused Melissus' attention on body, bulk, space, magnitude and infinity with the result that the latter conceives Being more patently as material, as spatially extended than did Parmenides.¹⁹¹ As a consequence, too, he asserts that Being is "infinite in magnitude" (Fr. 3), it is both temporally everlasting and spatially infinite (Fr. 4).

Another influence may have been latter-day opponents of Eleaticism. Who were they? According to what he himself calls "a hazardously conjectural and a sadly incomplete reconstruction,"¹⁹² Raven suggests they were Pythagoreans. In his own day Parmenides had opposed "the fundamental doctrines on which Pythagorean cosmology was erected, the simultaneous postulation of an eternal principle of Unity and of another principle in opposition to it, and the derivation from the two of a world of plurality, change and motion" (*ibid.*, p. 75). Zeno too had challenged the Pythagorean theory (among others) that "things are equated with sums of spatially extended units" (*ibid.*).¹⁹³ In his turn Melissus faced Pythagorean counterattacks upon Parmenides.

[The Pythagoreans] may simply have concentrated on demonstrating that, even on Parmenides' own showing, the One was not truly one but many. "Granting," they would have said, "that the One is a finite sphere, what then lies outside its limits? Clearly the void. Reality, then, is not one but two." And again: "Granting that the One is a finite sphere and, as such, equally poised from the middle to the circumference. then it must have a beginning, a middle and an end. Reality, then, is not one but three" (p. 85).

Many scholars have firmly rejected Raven's reconstruction.¹⁹⁴ True

¹⁹⁰ On this concentration see *supra*, "Conclusions" in "Zeno" section; also see n. 154.

¹⁹¹ We must remember, too, that Melissus' conceptions were expressed literally, Parmenides' figuratively. The latter does, though, conceive of Being as somehow material. See G. B. Kerferd, *PR*, 76 (1967), 521: "The world of Truth seems avowedly physical rather than geometrical in character"; G. Vlastos, *EP*, VIII, 377: "Incorporeality of Being is never asserted by Parmenides."

¹⁹² Raven, *PE*, p. 86.

¹⁹³ See also pp. 78-79, 81-82.

¹⁹⁴ For example, H. Cherniss terminates his review of Raven's *PE* by stating:

enough, documentary evidence is almost completely lacking. Yet, as Raven suggests, "it seems to fit all the deplorably few facts that are known; [and] so far as it goes it makes a coherent picture" (*PE*, p. 86). Parmenides did liken Being to a finite sphere, equally poised from the middle to the circumference. Possibly someone might have pictured that sphere as encompassed by void and as entailing beginning, middle and end. Melissus did eliminate void from his universe (Fr. 7, 7-10) and so Being became free from encirclement and, thus, infinite and single (Frs. 5 and 6; see also Aristotle, *De Generatione et Corruptione*, 325a14, KR 300). Likewise, he actually did exclude beginning and end from Being, which thereby became unlimited temporally and spatially (Frs. 2 to 4). What Raven recommends is that the possibility sandwiched between the two layers of facts is so consistent with those facts that it itself may be factual.¹⁹⁵ His recommendation has this advantage that it helps explain how Parmenides and Melissus could share a basic doctrine on Being and still be at odds on such a crucial attribute as infinity. Melissus may have found its affirmation unavoidable under pressure from opposition Parmenides himself never experienced.

The third external factor possibly influencing Melissus has been suggested by J. Owens: his Ionian background. In Owens' view both Parmenides and Melissus consider Being to be without beginning and without end. Yet Parmenides expresses that fact by "limited," Melissus by "unlimited."¹⁹⁶ Melissus' mode of expression can perhaps be explained by his "more immediate Ionian surroundings, [since he may be] endeavoring to apply the Eleatic doctrine to the 'unlimited' basic reality that had been traditional with the Milesian thinkers" (p. 93).¹⁹⁷ What might this scholar mean?

"Readers of this book should... be warned that almost every interpretation on which his reconstruction is based is open to serious question" (*PR*, 59 [1950], 377). Also see G. Vlastos, *EP*, VIII, 376-77; Tarán, p. 154; *supra*, note 174.

Some (e.g., Tarán, p. 154, 200; G, vol. II, 104-105, 115-18) consider Melissus at times to be arguing vs. Empedocles and Anaxagoras. Loenen (pp. 160, 167-70) disagrees and emphasizes his influence on Leucippus (pp. 172-74). Opinion is not unanimous either on whether Melissus may in Fr. 8 have suggested atomism to the Atomists. Some say yes (Burnet, p. 327; Raven, *PE*, p. 86); others say no (G, vol. II, 117; Owens, *History*, p. 98), partially because it is not certain who is chronologically first – Melissus or the Atomists (see G, vol. II, 101-102, 117-18). Also see S. Zepi, "L'antipluralismo di Melisso," *RSF*, 17 (1962), 321-27.

¹⁹⁵ See KR 300-301. This seems certain: Melissus was reacting to opposition not felt by Parmenides – either from Pythagoreans (Raven) or from the pluralists or Atomists.

¹⁹⁶ *History*, p. 92. Also see pp. 93, 95 and 97.

¹⁹⁷ His "more immediate Ionian surroundings" are due, of course, to his having lived in Samos. See G, vol. II, 101-102.

As should be clear from previous sections, Milesian philosophers tended to identify reality with some single infinite stuff (e.g., Anaximander with *to apeiron*, Anaximenes with infinite air), which served as source and nurse of the visible universe. The fact it was infinite insured that reality was inexhaustible, intraversable, everlasting, uncontained, autonomous. In this monistic and simplified scheme of things, reality's status of infinity was a perfection. Next in the history of Greek ideas came the early Pythagoreans, who retained *to apeiron* as an *arche* but added *peras* as a second and dominant *arche*. It was active, infinity was passive. It was the determinant and formal factor, infinity the determinable and material factor. It was the perfective side of reality, infinity the perfectible and perfected side. It was synonymous with the presence of number and structure, infinity with absence of such elements but in such fashion that it could receive and profit from them: it complemented *peras*. Both were needed to make a world.

Upon inheriting this Pythagorean dualism of *peras/apeiron*, Parmenides discarded its *apeiron*-dimension and developed the remnant into a monism of *peras*. No *apeiron*-factor is needed, since reality does not evolve: it *is*, simply. Reality allows no absenteeism: all is present and all at once. *Peras* is the word to express that state of simultaneous omnipresence. One can say, then, that reality is definitely just what it is: changeless, temporally successionless, unique, homogeneous, coherent, self-identical, inclusive, complete. Or one can save words and yet express as much by simply stating that Being *is* limit.

When Melissus inherited Parmenides' monism, he welcomed its insight into reality as motionless, everlasting, unique, homogeneous, full, all-perfect, complete. But when he came to select a word to describe the presence within Being of those perfections which would have been absent were Being spatially confined or temporally curtailed, he chose *apeiron* and not *peras*. Why so? The choice may have been suggested to him, as we have already remarked, by Zeno's preoccupation with infinity or by contemporary opponents of Parmenides' finite sphere. But it may also have come from his having lived among Ionians. Their philosophical ancestors, if they were consistent with the basic tenets of a cosmogony, would have regarded being limited as equivalent to being in an imperfect and incomplete condition. Why? Because in a cosmogony reality gains perfection by developing and growing; but limit puts an end, a stop to development and growth; therefore, limit is equivalent to the restriction, exclusion, absence of gain and perfection. Hence, *peras* is (so to speak) a bad word, *apeiria* a good word. If such was the attitude behind early

Milesian cosmogonies and if it did infiltrate Melissus' subconscious, then it may have helped determine his preference for *apeiria* to *peras* within an otherwise Eleatic doctrine.

This preference should, of course, cause an Eleatic second thoughts. Infinity is apt and even necessary in a cosmogony, where, as just indicated, perfection is accumulated through development, change, motion – in a word, through becoming. Infinity in becoming guarantees that the accumulation will be temporally and spatially endless. But that same infinity also is a sign of imperfection. Reality develops in order to acquire what it does not yet possess: if it already possessed everything possible, there would be no need of development. Development through an infinity of space and time is a confession that reality is never gathered together all at once but only in a piecemeal and successive fashion. But an Eleatic philosopher excludes all development and change from reality since it is already. It has all the perfections which elsewhere might be achieved cosmogonically, and it has them all at once. As Parmenides states (Fr. 8, lines 3-6): "Being is ungenerated and imperishable, whole, unique, immovable and complete. It was not once nor will it be, since it is now altogether, one" (ἐπεὶ νῦν ἔστιν ὁμοῦ πᾶν, ἕν). How can Melissus introduce *apeiria* into such a theory except at the risk of perverting either the one or the other?

However that may be, though, there is no doubt that Melissus did characterize Eleatic Being as infinite rather than as limited. There is also little doubt but that Being's infinity is one of temporal and spatial expansion, however difficult it is to reconcile such infinity with the notion of a Being which is without body, bulk or parts.¹⁹⁸ Yet Melissus' Fragments seem to demand just such a reconciliation.

¹⁹⁸ Would Melissus' infinity of time and space, if articulated, correspond to Aristotle's own doctrine of temporal and spatial infinity? No matter how great or how enduring Being is, one can always conceive of it as extending further and of lasting longer. Being would be actually finite in its extent and duration, then, but potentially infinite insofar as adding to it need never cease. If such correspondence is warranted, Melissus' infinity would share the characteristics of Aristotle's: potentiality, unintelligibility, imperfection, incompleteness (see above, "Conclusions" in "Zeno" section). These characteristics should cause Melissus even third thoughts about coupling infinity instead of limit to Eleatic Being. (Anaxagoras' infinity would be similar to Aristotle's, seemingly – see below, n. 266).

Or, as appears more likely, is Melissus among those whom Aristotle (*Physics*, 206b33 sq.; see below, "Infinity" in "Atomists" section) considers to hold an actual infinite? If so, Melissean Being is that which has nothing outside it because its limitless expanse embraces all reality.

CHAPTER V

POST-PARMENIDEAN PHILOSOPHERS

Empedocles, Anaxagoras and other Presocratics subsequent to Parmenides are important in the history of thought. The first has been described as "one of the most complex and colourful figures of antiquity" (G, vol. II, 123). Although not an original thinker, still he enchanted "his readers with his presentation of philosophical doctrine, and so he has drawn abundantly the attention of historians of philosophy both ancient and modern" (J. Owens, *Hist.*, p. 110). Anaxagoras' intuitions "were exceptionally profound and fecund. They attained high significance in the subsequent development of Greek philosophy. His insights and his brilliant power of synthesizing them in the explanation of the cosmos rightly entitled him to be called the greatest of the Greek physicists" (*ibid.*, p. 126). Democritus, who developed Leucippus' atomism, had "truly remarkable gifts . . . [of] assimilating current knowledge and organizing it into a consistent whole . . . [and presenting] it in a way that had a lasting appeal . . . His was an encyclopedic type of mind, and his pioneer accomplishment of bringing together into a single corpus all the knowledge of general interest to his times was in itself an original achievement of high importance in the history of scientific undertakings" (*ibid.*, p. 150).¹⁹⁹

All those authors, then, are of consequence intellectually. But they have another common characteristic: their philosophical positions are reactions to Parmenides, who

seemed, to his contemporaries and immediate successors, to have established once and for all certain canons with which . . . all future cosmologists must somehow comply. Being, in the first place, must not be allowed to spring from Not-being: anything that was claimed as real must also be ultimate. Again, the void, being sheer non-existence, can find no place in any account of reality. Third, plurality cannot come from an original unity: if there is to be a plurality, it too, like

¹⁹⁹ Also see Cyril Bailey, pp. 1-5; G. E. R. Lloyd, "Leucippus and Democritus," *EP*, IV, 450; Giorgio De Santillana, *Origins of Scientific Thought* (Chicago: University of Chicago Press. 1961), p. 141.

reality, must be ultimate. And finally, motion must no longer be simply taken for granted, an explanation must be given of its existence – which involved also an explanation and justification of sense-perception.²⁰⁰

Accordingly, our investigation in each of the following sections will proceed along similar lines. We shall first sketch how each author reacts to Parmenides and then comment upon his views on *apeiron*.

EMPEDOCLES

On occasion Empedocles of Acragas in Sicily (ca. 492-ca. 432)²⁰¹ breaks sharply with Parmenides, as in his defence of the senses.

Fr. 3, 9 (G, Vol. II, 139; KR 325): Come now, observe with all thy powers how each thing is clear, neither holding sight in greater trust compared with hearing, nor noisy hearing above what the tongue makes plain, nor withhold trust from any of the other limbs [organs, parts of the body], by whatever way there is a channel to understanding, but grasp each thing in the way in which it is clear.

At other times, though, he goes along with the Eleatic author, whose language he even echoes. They are fools, Empedocles asserts in Fragments 11 and 12 (G. vol. II, 139; KR 323), “who suppose that what formerly was not can come into being or that anything can die and perish wholly. For there is no means whereby anything could come to be out of what in no way is, and it cannot be brought about or heard of that what is should perish.” “What could increase this All?” he asks in Fr. 17, 32. “Whence could it come? And how also could it perish, since nothing is empty of these things?”²⁰²

But on still other occasions he mingles agreement with disagreement so as to rescue the phenomenal world from unreality.²⁰³ This coalition is nowhere more apparent than in his doctrine of the four elements and of Love and Strife.

Fr. 17, 16-20 (G, vol II, 153; KR 326-28): At a certain time one alone grew out

²⁰⁰ KR 319. Also see G, vol. II, 120-21; Kurt von Fritz, “*Nous, Noein and Their Derivatives*,” p. 236; C. Bailey, pp. 26-27; L. Tarán, p. vii.

²⁰¹ See G, vol. II, 128; also see *ibid.*, p. 348 for a helpful “table of chronology” for all the philosophers, poets, public figures and events of the fifth century; KR 321.

²⁰² For additional denials of the void, see Fragments 13 and 14, G, vol. II, 139.

²⁰³ See G, vol. II, 176, n. 2: “Empedocles respects [Parmenides] to the limit compatible with the existence of a phenomenal world”; KR 329; T. G. Sinnige, pp. 111-17.

of many, and at another it grew apart to be many out of one: fire and water and earth and the immense height of air, and cursed Strife apart from these and equal in every respect, and Love among them, equal in length and breadth.

Ibid., lines 6-12: They [the four elements] never cease thus to alternate continually, now all coming together into one through Love, and now again each one drawing apart by Strife's hatred. Thus in that they have learned to grow one from many, and as the one is divided turn into many again, in this way they suffer becoming and have no steadfast life; but in that they never cease from alternately coming together and separating, they are for ever, unshaken on their circular path.

Let us grant, Empedocles argues, that reality cannot come from un-reality nor plurality from unity, and that strict motion is impossible. But these concessions do not eliminate the sensible universe nor the development and history it suggests. What is ultimate and truly real is not unity but a plurality: fire, earth, water and air. From these all else is derived. The physical cosmos and the inorganic and organic existents it contains are nothing but those four "roots" arranged and then re-arranged in different proportions under the influence now of Love, now of Strife, which are ultimate realities also. Hence, although change, strictly understood, does not exist, there is "cosmogony" of a sort – the arrangement and re-arrangement just mentioned. (G, vol. II, 147-59; KR 324, 327-30).

But however much Empedocles may seem to differ with Parmenides, there still persists an Eleatic residue. His four elements are not only sentient and divine: they are also "(a) ungenerated and indestructible, (b) qualitatively unalterable (c) homogeneous throughout (fr. 17, 35). In all this they are, as it were, the Parmenidean One multiplied by four" (G, vol. II, 147). In fact, at one stage of Empedoclean cosmogony the four elements become even more assimilated to the One. This occurs when Love is in full control of reality. She then has so completely mingled the elements that their separate natures are indistinguishable (G, vol. II, 166) and they coalesce into a unity which is as close to Parmenides' Being as multiplicity can perhaps come. Empedocles even pictures them as constituting a sphere, which is an obvious throwback to Parmenides.²⁰⁴

²⁰⁴ See Simplicius, *Commentary on De Caelo*, 293, 18 (G, vol. II, 168): "Love brings all things together into one, destroys the cosmos created by Strife and makes of it the Sphere."

The fact that the Sphere is "equal to itself from every side" (Fr. 28; KR 325) and is "in all directions equal to itself" (Fr. 29; KR 326) also shows influence of Parmenides' Fr. 8 (lines 42 and 49), where the sphere to which his Being is likened is said to be "from the middle everywhere of equal strength; . . . from every point it is equal to itself." See W. Jaeger, *TEGP*, p. 141 and n. 62; G. Calogero, "L'eleatismo di Empedocle," *Studi in onore di L. Castiglioni* (Firenze: Sansoni, 1960), I, 127-67.

It is while speaking of the sphere that the Sicilian philosopher makes his sole extant reference to infinity or limitlessness.

Fragments 27 and 28 (after KR 325-26): Here are distinguished neither the swift limbs of the sun nor the shaggy might of the earth nor the sea; but rather, equal [to himself] from every side and altogether without limit (πάμπαν ἰσπεῖραν), he stays fast in the close covering of Harmony, a rounded sphere rejoicing in his circular solitude [or, perhaps: stillness, peacefulness].

What does Empedocles mean? What role does *apeiron* play in his universe?

Manifestly, it is a characteristic of the sphere which Love fashions from the four elements when reality is completely under her dominion. When and how does this happen? Before replying we must mention the eruption (to use Michael C. Stokes' word) in Empedoclean studies which occurred in 1965.²⁰⁵ Up to that date scholars from the time of Zeller and of Burnet had almost universally interpreted Empedocles as holding two cosmogonies. The first was "a cosmic cycle proceeding from the Sphere dominated by Love through a period when Love is retiring and Strife advancing to a point where Strife is completely dominant. Then the process is reversed and the world passes from the domination of Strife through a period when Strife is retiring and Love is advancing to a re-establishment of the domination of Love. A world like ours occurs at two points in the cycle, one on the way to the rule of Strife and the other on the way to the rule of Love" (G. B. Kerferd, *CR*, n. s. 17 [1967], 148; also see C. H. Kahn, *Gnomon*, 41 [1969], 442). But in 1965 three scholars, working independently, challenged that interpretation and recommended a view similar to that first proposed by von Arnim at the beginning of this century.²⁰⁶ "Empedocles believed," Kerferd states in his summary of this

²⁰⁵ *PQ*, 17 (1967), 166.

²⁰⁶ The three scholars and their studies are: F. Solmsen, "Love and Strife in Empedocles' Cosmology," *Phronesis*, 10 (1965), 109-148; U. Hölscher, "Weltzeiten und Lebenszyklen. Eine Nachprüfung der Empedokles-Doxographie," *Hermes*, 94 (1965), 7-33; Jean Bollack, *Empédocle*, Tome I: *Introduction à l'ancienne physique* (Paris: Éditions de Minuit, 1965), pp. 95-124. Hans von Arnim made his proposal in "Die Weltperioden bei Empedokles," *Festschrift Theodor Gomperz* (Wien: A. Hölder, 1902), pp. 16-27. Solmsen mentions Zeller, Tannery, Diels and Jaeger also as favoring a single cosmogony ("Love and Strife," p. 110, n. 3).

For a full and nuanced history of the older and newer interpretations, see Denis O'Brien, *Empedocles' Cosmic Cycle* (Cambridge: University Press, 1969), pp. 157-60. O'Brien finds Bollack to have led the way in challenging the older view with his article, "Die Metaphysik des Empedokles als Entfaltung des Seins," *Philologus*, 101 (1957), 30-54, which then influenced (among others) Solmsen and Minar (see "Cosmic Periods in the Philosophy of Empedocles," *Phronesis*, 8 [1963], 127-45). Jean Bollack gives a synopsis of Solmsen's, Hölscher's and his own views in

view, "not in a cycle operating between two extreme poles with a twofold creation of the world, but in a single creation which was the joint work of Love and Strife. There is indeed a return from this world to the Sphere but the correct analogy is that of a race-course where the goal is simply a return to the starting point" (CR, p. 148; also see C. H. Kahn, *op. cit.*, pp. 444-45). Or, in Solmsen's version ("Love and Strife," p. 120), Strife has "built up Cosmos [= the physical frame of the universe – Heaven and the heavenly bodies, the air between Heaven and Earth, finally Earth itself and the sea] by separating the elements and is even now... continuing to keep them separated, although it has passed the height of its power. Love does not create a Cosmos but fashions living beings." But what of the sphere? Where does it fit in?

The Sphairos would be a good *arche*.... If we can reconstruct Empedocles' cosmological account on analogous lines [to Anaxagoras', Anaximander's, Parmenides' accounts], the hypothesis that he thus proceeded would, if by no means firmly established, yet enter the competition with certain advantages. I should, however, not exclude the possibility that Empedocles "led up" to the Sphairos by describing how Love brought together the elements from all sides to merge them in the One (p. 127).

Reaction to the 1965 presentations of the theory of a single cosmogony has been mixed. C. Ramnoux speaks of Bollack's book as "la brillante reconstruction" ("Pourquoi les Présocratiques?" *RPhL*, 66 [1968], 405). C. H. Kahn grants that Bollack's treatise is "an extraordinarily difficult one" (*op. cit.*, p. 439) but adds that its author "gives a coherent reading of the entire physical doctrine, based upon a sensitive and meticulous study of the fragments, the testimonia, and the parallels in Lucretius and in the Timaeus" (*ibid.*, p. 440). Accordingly, "whatever doubts one may harbour about the details of this [Bollack's] scheme, its coherence, its simplicity, and the light it sheds on the fragments is so great that I think we must regard it as having definitely replaced the theories of Zeller and Burnet as the natural candidate for a standard interpretation of Empedocles" (*ibid.*, p. 445). On the other hand, in 1967 Denis O'Brien characterized "Hölscher's denial of any cyclic repetition in Empedocles" as "very misguided" ("Empedocles' Cosmic Cycle", *CQ*, n. s. 17 [1967],

Gnomon, 38 (1966), 726 and in "Les Zones de la cosmogonie d'Empédocle," *Hermes*, 96 (1968), 239-40. In this latter he also mentions an author who holds with Hölscher and Solmsen (Walter Bröcker, *Die Geschichte der Philosophie von Sokrates* [Frankfurt am Main: Klostermann, 1965]) and another who accepts the traditional view but makes Love be the sole moving cause in both cosmogonies (C. W. Müller, *Gleiches zu Gleichem* [Wiesbaden: Otto Harrassowitz, 1965], pp. 26-64).

p. 29, n. 1). In his 1969 book he states that "Minar's work is aporematic in style and the conclusions are somewhat ill-defined" (*Empedocles' Cosmic Cycle*, p. 160). Bollack's language seems "in many places imprecise and on the whole unsuited for the discussion of a Presocratic." The mere description "of some of Bollack's conclusions may perhaps obviate the need for much detailed criticism" (*ibid.*, p. 161). Although Solmsen's essay is "a more satisfactory work" (*ibid.*, p. 163), still he has not escaped radical misconceptions of Empedocles' thought (*ibid.*, pp. 181-89). O'Brien's final verdict is that "this small series of scholars" (*ibid.*, p. 159) has failed to displace the older vulgate interpretation of Empedocles (see *ibid.*, p. 156), which he personally exposes and defends throughout his book.

Opinion, then, is divided on the recent expositions of Bollack, Hölscher and Solmsen.²⁰⁷ Fortunately, a decision on the matter is not crucial to our topic. Whether the Empedoclean universe entails one or more cosmogonical processes, whether such begin or/and terminate with the sphere of Love, makes no radical difference: infinity remains a characteristic of the sphere.²⁰⁸ The relevant inquiry is what such an attribute signifies.

²⁰⁷ F. A. Wilford ("Embryological Analogies in Empedocles' Cosmogony," *Phronesis*, 13 [1968], 108-117) sandwiches a survey of Solmsen's, Hölscher's, Minar's and O'Brien's articles between the statements that "the whole structure of Empedocles' cosmology is under intensive review" and "the field is, for the moment at least, wide open for discussion" (*ibid.*, pp. 115 and 117). For another review of J. Bollack's book, see J. Brunschwig, *RPhilos*, 92 (1967), 128-33.

²⁰⁸ As the quotation just given indicates, F. Solmsen ("Love and Strife," p. 127) thinks the Sphere could be either an *arché* or a terminus. W. Jaeger considers it to be "the stage when the divine Love which keeps the world going has realized its dominion and becomes fully achieved" (*TEGP*, p. 141). But J. E. Raven, who espouses the double cosmogony theory, puts the sphere at the first stage of the cosmic cycle, although he points out that this priority is logical rather than chronological since "the cycle is never-ending and has therefore no chronologically first stage" (KR 327).

E. L. Minar's position on the sphere is ambiguous. "Cosmic Periods," p. 128: Fragment 17, 7 ("Sometimes all things come together, by Love, *into one*") can "be interpreted to mean that at the triumph of Love the world becomes a thoroughly uniform mixture, motionless and spherical," although "really early evidence for such an interpretation is scanty." *Ibid.*, p. 133: "There is little or nothing to suggest the divine Sphere, as equivalent with the totality of things, at the apogee of Love, in the fragments themselves, in Aristotle or Theophrastus, and also not in the Peripatetic doxographical tradition." *Ibid.*, p. 135: "Perhaps the question is best left undecided whether the whole was spherical either all the time or at the two extreme states."

For Denis O'Brien "sphere" in Empedocles means "the elements bound together by Love in a non-cosmic state, as described in Fr. 27" (*Empedocles' Cosmic Cycle*, p. 4, n. 2). *Ibid.*, pp. 139-40: "We conclude therefore that most likely Love is stretched out in the form of a sphere, 'equal (as it were to herself) in length

Its signification is elusive. Empedocles' sphere is somewhat similar to Anaximander's *apeiron*. Both are unified masses which, rightly conceived, contain all that is and are the sources of all that will be.²⁰⁹ Anaximander designates his *arché* as infinite, pointing thereby to its inexhaustibility, eternity, immensity, escape from containment by anything else (see above, Ch. II, "Anaximander" section). But he nowhere explicitly describes it as a sphere.²¹⁰ Although Empedocles' sphere can with some reason be termed inexhaustible and immense (hardly in a strict or full sense, though), still it is transient rather than everlasting since it is dependent upon Love's getting and keeping the upper hand. It also appears to be contained by Strife's residing at its outermost circumference.²¹¹

What about Parmenides? Would it not be enlightening to interpret Empedocles through Parmenides? The difficulty is that even though the latter likens Being to a sphere, he identifies it with *peras* (see above, Ch.

and breadth,' Strife is 'equally balanced on every side,' or more simply 'equal on every side,' because it forms a hollow spherical layer, presumably surrounding Love" (also see p. 144). Finally, *ibid.*, p. 242: "Empedocles is obviously indebted for his notion of the Sphere to Parmenides. The Sphere is motionless, homogeneous, equal from every direction, and lacking in all the sensible properties which we associate with sun, land and sea." Yet "what is significantly new is the relation of the Sphere to the sensible world. Parmenides' sphere, since it exists in a timeless present, and since it is also spatial, reduces the sensible world to mere illusion. Empedocles attempts to preserve Parmenides' insight into the nature of the one and yet to restore the sensible world to reality by making the one and the many exist *in succession*. In this way the many are not merely illusory, while the one retains many of the characteristics of Parmenides' sphere, without yet ceasing to be spatial." Thus, one ensures "endless cyclic succession of the one and many" by having the sensible world "provide a movement away from the Sphere and a movement leading back to the Sphere" (*ibid.*, p. 244).

²⁰⁹ See G, vol. II, 166, who refers also to Cornford. On Anaximander's *to apeiron* as a mechanical structure of opposites (Jaeger, McDiarmid, Wiśniewski), or a chemical fusion (Cornford, Guthrie) or, best of all, as prior to opposites as a tree is to its seeds before flowering (Kahn, Gottschalk), see above, Ch. I, "Recent Studies in Anaximander," and pp. 57-58, as well as *infra*, n. 230.

²¹⁰ Vs. F. M. Cornford, *Prin. Sap.*, pp. 176-77; G, vol. I, 85; T. G. Sinnige, pp. 11, 112. See C. H. Kahn, p. 235, n. 1.

²¹¹ D. O'Brien, *CQ*, p. 37: "Strife too, we suggest, is arranged in the form of a sphere, 'equal on every side (sc. to itself)' or perhaps 'equally balanced on every side.' The difference will be that, since Love . . . moves to and from the centre of the world, therefore Strife will form not a solid but a hollow sphere. That is, Strife will form an even spherical layer surrounding Love." Also see *idem*, *Empedocles' Cosmic Cycle*, pp. 1-2, 245-46. H. S. Long, "The Unity of Empedocles' Thought," *AJP*, 70 (1949), 157: "Originally the four elements formed a great globe, 'the sphere,' held together by Love; Strife was on the outside." F. M. Cornford, *Prin. Sap.*, p. 177; "This boundless sphere, moreover, actually has something enveloping it on the outside, namely Strife, which has been expelled from the spherical mass."

IV, "Parmenides" section).²¹² What about Melissus? True enough, his Being is infinite in magnitude (see above, Ch. IV, "Melissus" section), but it is not a sphere (not explicitly, at least).

What, then, might Empedocles mean by a sphere which is "altogether without limit"? Possibly, that it is internally homogeneous and externally uniform. Its homogeneity arises from the fact that the four elements it contains are so completely harmonized under Love's spell as to be indistinguishable.²¹³ The differences and opposition between them cease to be operative, the limits separating them dissolve and merge for a time. Thus, the sphere is, as it were, without internal limits. Its external uniformity is rooted in its intraversability: in traveling around it, one would never come to its end because it has none. "As the geometers point out, a circle has beginning and end at every point"²¹⁴ and, thus, has no beginning or end

²¹² Vs. R. Mondolfo, who finds Parmenides, no less than Empedocles, to have *la sfera infinita* (pp. 367-69; see above, n. 144); G. Calogero, *Studi Sull 'Eleatismo*, pp. 25-29; T. G. Sinnige, pp. 29-48, 85-86; V. Guazzoni Foà, "Un ripensamento sulla *sphaira* di Parmenide," pp. 344-54. On Parmenides and Empedocles, see D. O'Brien, *Empedocles' Cosmic Cycle*, pp. 239-41, 242-45 (see above, n. 208, last paragraph).

²¹³ Within the sphere "are distinguished neither the swift limbs of the sun nor the shaggy might of the earth nor the sea" (Fragments 27 and 28; KR 325). See C. H. Kahn, "Religion and Natural Philosophy in Empedocles' Doctrine of the Soul," *AGPh*, 42 (1960), 9: "When he comes to describe the fullest manifestation of this principle [Love], Empedocles passes beyond the realm of generation and corruption to portray the perfect form of a universal Sphere within which, for a certain time, all the elements are periodically immobilized and transfigured under the absolute sway of Love"; *idem*, *EP*, II, 497; F. Lämmli, *Vom Chaos zum Kosmos*, I, 45; K. von Fritz, "Der *Nous* des Anaxagoras," *ABG*, 9 (1964), 96: Love "im Weltwerdungsprozess selbst scheint sie keine andere Funktion zu haben, als die verschiedenen Elemente, aus denen die Welt besteht, so gründlich und vollständig als möglich miteinander zu vermischen, so dass wenn sie dem Ende einer Weltperiode die vollständige Oberherrschaft gewonnen hat, sich alles in einem Zustand vollständiger Mischung befindet und nichts Einzelnes mehr als solches erkennbar ist"; Hazel E. Barnes, "Unity in the Thought of Empedocles," *CJ*, 63 (1967), 23; F. Solmsen, "Tissues and the Soul," *PR*, 59 (1950), 438 and n. 11; *idem*, *Aristotle's System*, p. 119; J. Longrigg, "Roots," *CR*, n. s. 17 (1967), 1-4.

Also see J. Bollack, *Empédocle*, I, 88: "Le *migma* et le *tout-ensemble* [of Empedocles] ressemblent à l'illimité d'Anaximandre, dans la mesure où ni le cercle de la sphère ni aucun autre principe ne les entourent. Mais la forme parfaite elle-même ne connaît pas de limite, car elle est le principe de toute limite. . . . L'illimité ne se définit ni par rapport à l'espace ni par rapport au nombre; il est ce qui n'a pas de structure, l'Amorphe, l'Indéfinissable." *Ibid.*, p. 199: "La sphère, partout égale à elle-même, n'a d'autre structure que la forme parfaite de sa propre circonférence." Also see *ibid.*, III, pp. 139-40, 240. Also see below, n. 230, second paragraph.

On cosmos in Empedocles, see J. Kerscheneiner, pp. 127-30.

²¹⁴ C. H. Kahn, p. 232. Also see Aristotle, *Physics* 207a2; G, vol. I, 85; Cornford, *Prin. Sap.*, pp. 176-77. Since Parmenides' Being is homogeneous in content

really. One can keep going around it indefinitely and without interruption. There are no terminations, no distinctions, no unevenness to disrupt passage around it. Hence, it has a completely uniform surface.

Such, then, is what Empedoclean infinity appears to be: not only the sphere's relative inexhaustibility and immensity but also its internal homogeneity and external uniformity.

ANAXAGORAS

Scholars are commonly agreed on the importance of Anaxagoras of Claxomenae (ca. 500-428). In Joseph Owens' opinion (noted above) he is rightly called the "greatest of the Greek physicists" because of "his insights and his brilliant power of synthetizing them" (*Hist.*, p. 126). According to Cyril Bailey (p. 34) his theories are "highly ingenious and in many ways far-sighted." Gregory Vlastos begins an influential article by stating that "no pre-Socratic system has been studied more intensively than that of Anaxagoras, and none with better reason since by common consent it is one of the most brilliant products of the great age of Greek speculation."²¹⁵

Despite agreement on his importance, though, few scholars agree on what his doctrines mean. "No Presocratic philosopher," J. E. Raven observes, "has given rise to more dispute, or been more variously interpreted, than has Anaxagoras" (KR 367). G. B. Kerferd bluntly states that "everything in the interpretation of Anaxagoras has been the subject of controversy, and some would say that the real nature of his thought cannot now be recovered."²¹⁶ As an example of such controversies consider contemporary views on whether or not Anaxagoras intends *Nous* to be material and divine. W. K. C. Guthrie (vol. II, 277-79) grants that possibly "Anaxagoras thought of Mind as being, though invisible and intangible, extended in space." Still, the Greek author repeatedly insists "that it is entirely separate from the mixture of everything which we should call matter . . . [Hence,] if any shred of materialism remains, it is very slight indeed . . . [Moreover, Mind] is nowhere in the extant fragments called God, but this may be accidental and it is impossible that Anax-

and spherical in shape, might he not have called it *apeiron* as Empedocles did his sphere? Apparently yes, but one must remember that he merely *likenes* Being to a sphere and that he identifies it with *peras*.

²¹⁵ G. Vlastos, "The Physical Theory of Anaxagoras," *PR*, 59 (1950), 21. Also see F. M. Cleve, *The Giants*, I, 168.

²¹⁶ "Anaxagoras," *EP*, I, 115.

agoras should not have thought of it as divine (*theion*).” But according to G. B. Kerferd, “the *Nous* of Anaxagoras . . . was unquestionably material, and Guthrie is not justified in inferring immateriality from its freedom from mixture with anything else.” However, it may very well have been conceived as “a divine living substance or force” since there was for Anaxagoras, as for all previous Pre-socratics, “no kind of inconsistency between the concepts of the physical and the divine.”²¹⁷ As seen by C. H. Kahn, though, “Anaxagoras’ principle of mind is clearly noncorporeal, but it is not described as a deity” (*EP*, II, 498).

Or take as another instance the debate on how to reconcile what F. M. Cornford calls the “Principle of Homoeomereity” and the “Principle of Universal Mixture.”²¹⁸ According to the first, gold (for example) consists of gold and nothing else, whereas the second demands that gold contains a portion of everything else since “there is a portion of everything in everything” (*CQ*, p. 1). Various reconciliations have been suggested. Some would ignore the Principle of Homoeomereity, which is not mentioned in the Fragments of Anaxagoras but only by Aristotle and the doxographers.²¹⁹ Others consider it part of Anaxagorean doctrine but

²¹⁷ *PR*, 76 (1967), 520. Also see *idem*, *EP*, I, 116; KR 374; K. von Fritz, “Der *Nous* des Anaxagoras,” pp. 92-95 (he compares the Anaxagorean Mind with Xenophanes’ God, Anaximander’s *to theion*); G. Vlastos, “Presocratic Theology and Philosophy,” p. 113, n. 76. For a survey of positions, see F. M. Cleve, *The Philosophy of Anaxagoras* (New York: King’s Crown Press, 1949), pp. 150-156; *idem*, *The Giants*, I, 317-320. Cleve himself seems to postulate that Mind is material but matter is itself enmeshed in consciousness (pp. 154-55). See *idem*, *The Giants*, I, 321: “Anaxagoras, too, is a *panzoist*, i.e., one to whom body and consciousness are still a unity not yet analysed. . . . The notions of a ‘matter without consciousness’ and a ‘consciousness without body’ do not yet exist.” See also *ibid.*, pp. 207, 265, 292. Daniel E. Gershenson and Daniel A. Greenberg, *Anaxagoras and the Birth of Physics* (New York: Blaisdell Publishing Company, 1964), pp. 379-445 provide an extensive (although somewhat prejudiced) survey of modern literature on Anaxagoras, beginning with the seventeenth century and up to 1962. For their own view on Mind, see pp. 29-30: “Mind must be different from everything in the perceptible universe; in particular, Mind must be different from all matter. . . . Mind is, in short, the opposite of matter: it is incorporeal.” (In using this book, one should keep in mind the justified criticisms made of it by such reviewers as G. B. Kerferd, *CR*, n.s. 16 [1966], 165-66; E. L. Minar, *CW*, 58 [1965], 200-201; Colin Strang, *Isis*, 56 [1965], 473-74). Also see M. Detienne, “Les origines religieuses de la notion d’intell. Hermotime et Anaxagore,” *RPhilos*, 89 (1964), 167-78; A. J. Cappelletti, “Sobre el concepto del *nous* de Anaxagoras,” *Universidad*, 42 (1959), 53-68.

²¹⁸ “Anaxagoras’ Theory of Matter,” *CQ*, 24 (1930), 1-31 and 83-95. G. Vlastos, “Physical Theory,” p. 50 calls Cornford’s study “one of the most thorough and thoughtful ever made.”

²¹⁹ For example, A. L. Peck, “Anaxagoras’ Predication as a Problem in Physics,” *CQ*, 25 (1931), 27-37 and 112-20; G, vol. II, 282. See below, n. 222.

weaken it by striking out the words, "and nothing else". Then gold can consist of gold and of everything else as well. Or they retain those words but take gold to be the name not of the entire mixture but of its predominant ingredient. Or they think the two Principles refer not to things themselves but to their "seeds" or "powers" or to the "opposites."²²⁰ To date the debate goes on, despite the fact that such suggestions "are of considerable ingenuity and elegance. The difficulty in all of them... is that they involve either complete rejection of, or at the very least radical surgery upon, the interpretation provided by Aristotle, Theophrastus, and Simplicius; [moreover] positive evidence for their support either in the fragments or elsewhere is almost completely lacking" (G. B. Kerferd, *EP*, I, 116).

Fortunately, neither of those two controversies is at the bull's eye of our topic. Having noted them, we can now direct our aim at Anaxagoras' doctrine of infinity. Of what does he predicate *apeiron*? What does it mean? Let us answer by first tracing those portions of his world-view which entail infinity.

Infinity and Matter

In elaborating his doctrine, Anaxagoras would seem to have been struck by what happens in nutrition. A man's or an animal's eating a single food such as bread brings about a great variety of products – "flesh, bones, veins, sinews, hair, nails, feathers also and horns in certain cases." A tree takes in water and produces "wood, bark, leaves and fruit."²²¹ One would be tempted to conclude that becoming, as well as concomitant perishing, has occurred: flesh, bones and so on begin to be and bread ceases to be. Plurality would seem to have emerged from unity. Being (e.g., flesh) seemingly comes from nonbeing (nonflesh *seu* bread) and, also, being (bread) disappears into nonbeing (nonbread *seu* flesh).

But Anaxagoras realizes such processes are only apparent since he also subscribes to Parmenides' conclusion that change or motion, strictly understood, is impossible. What seem to be a coming-into-being and a perishing is, in truth, mere aggregation and separation.

Fr. 17, Simplicius *In Phys.*, 163, 20; G, vol. II, 329; KR 369: The Greeks have

²²⁰ For a useful survey, see G. B. Kerferd, *EP*, I, 115-16 and *APQ*, pp. 138-39. Also see Cyril Bailey, pp. 537-45; Margaret E. Reesor, "The Meaning of Anaxagoras," *CP*, 55 (1960), 1-8.

²²¹ Simplicius, *In Phys.*, 460, 15; G, vol. II, 331. Also see Aëtius, I, 3, 5; G, vol. II, 332.

a wrong conception of becoming and perishing. Nothing comes to be or perishes, but there is mixture and separation of things that exist. Thus they ought properly to call generation mixture and extinction separation.

But how allow even mixture and separation without betraying Parmenides? The answer arises from combining several facts. No one kind of popularly recognized physical substances (e.g., flesh, bone, hair, sinews; wood, bark, sap, etc.; gold, iron and other metals; hot/cold, sweet/bitter and other "opposites") is prior or more basic than any other.²²² Secondly, any one kind contains all the others, although in such a way that it predominates in quantity and power so as to retain its own distinctive nature and characteristics.²²³ The application of force upon it separates the kinds of stuff it contains and they re-align themselves. For instance, eating breaks up bread into flesh, bone, veins, hair, etc., each of which joins (and thereby nourishes) the flesh, bone, veins, etc. of the person eating. In this process no intrinsic or genuine change occurs either in the food itself or in the organic body nourished. The flesh-, bone- and other particles were imperceptibly but actually present already in the food and now become present in the body. What transpired is (literally) a dislocation and a relocation, a division and a re-grouping.²²⁴

²²² This interpretation is based on A. L. Peck, *art. cit.* in n. 219 above; especially on G, vol. II, 279-94. The first three kinds of substance listed (i.e., all besides the "opposites") Aristotle called "homoeomerous" in his own theory as "parts identical in name and nature with the whole." When mentioning them in reference to Anaxagoras, he used the same expression for sake of convenience without however intending "to saddle him with any doctrine that however far one divides any of his elements the parts will always be like the whole" (G, vol. II, 282-83).

Anaxagoras seems to have thought neither of such substances nor of the "opposites" as "elements" since "for Anaxagoras there is no such thing as a simple body" (G, vol. II, 292). "Earth," "water," "air" and "fire," as well as "bread," "tree," "animal" and the like, are all collective nouns, expressing a more complex grouping of the physical substances just listed. Actually, he did not put the question, "What are the elements of physical bodies?" He asked rather: On what hypothesis of the nature of matter can one explain the apparent change of one substance into another... without assuming the creation of new substance which is forbidden by the law of Parmenides?" (vol. II, 293-94). See T. G. Sinnige, pp. 136-37.

On "homoeomerous" (and cognate words), see G, vol. II, 325-26; C. Bailey, pp. 537-56; G. Vlastos, "Physical Theory," pp. 41-57; F. M. Cleve, *The Giants*, I, 173-96, where he distinguishes between *moirai* (= ultimate particles or seeds, which are bright/dark, warm/cold, rare/dense, moist/dry and so on, plus various shapes, surfaces, quantities, intensities) and *mereia* (= molecule of *moiras*); D. E. Gershenson and D. A. Greenberg, *Anaxagoras*, p. 476, where they state "homoeomery" has two meanings: "substance composed of molecules" and "molecules of (various) substances."

²²³ Aristotle, *Physics*, 187b6; Simplicius, *In Phys.*, 163, 2.

²²⁴ Fr. 17. Simplicius. *In Phys.*, 163, 20; G, vol. II, 329 (also see pp. 271-72);

And no matter how radical and new a future process may be, it will not be an authentic change nor will any genuinely “new” product result. Why not? Because Anaxagoras does not restrict the kinds of physical stuff contained by something to any definite number (vs. Empedocles who postulates only four elements) but considers them to be, indeed, endlessly numerous and varied.

Text I: Aristotle, *Phys.*, 187a23; G, vol. II, 328; KR 378-79: The difference between them [Empedocles and Anaxagoras] is that . . . one posits an infinity of things, the homoeomers and the opposites (ἄπειρα, τὰ τε ὁμοιομερῆ καὶ τὰναντία), the other only the recognized elements. Anaxagoras’ assumption of an infinite number (ἄπειρα) appears to have been due to his acceptance of the universal view of the natural philosophers that nothing is generated from what is not. That is why they say things like “All things were together” and “To become such-and-such is only alteration,” while others speak of mixture and separation.

And even if someone might attempt to divide something endlessly, it still would not result in anything “new” coming-into-being or in anything “old” going-out-of-being: each kind of stuff is infinitely divisible. Any act of division always terminates with two portions, each of which is in turn divisible (in theory if not in practice). And each portion, no matter how small, still remains the sort of thing it was and contains all other kinds of matter.

Text II: Simplicius, *In Physicorum*, 164, 14; G, vol. II, 335: That the principles were infinite he [Anaxagoras] says right at the beginning [of his book]: [Fragment 1] “All things were together, infinite both in number and in smallness” (ὁμοῦ πάντα χορήματα ἦν ἄπειρα καὶ πλῆθος καὶ μικρότητα) and that there is neither a smallest nor a largest among the principles: [Fr. 3] “Of the small,” he says, “there is no smallest, but always there is something smaller; for it is impossible that what is should not be. Similarly there is always a larger than the large, and it is numerically equal to the small. In relation to itself everything is both large and small.” For if everything is in everything, and everything is separated out from everything, even from that which seems smallest something smaller than it can be separated out, and what seems largest has been separated out from something larger than itself. . . . Elsewhere he says: [Fr. 6] “And since both the large and the small have portions equal in number, in this way too everything must be in everything. Separate existence is impossible, but everything has a portion of everything. When it is impossible for there to be a smallest, nothing can become separated or by itself, but just as in the beginning, so now also all things are together. Everything contains many things, the larger and the smaller containing an equal number of the things being separated off.”

Simplicius, *ibid.*, 27, 2; G, vol. II, 330. See Gershenson and Greenberg, *Anaxagoras*, pp. 10-11.

The preceding paragraphs sketch Anaxagoras' attempt to do justice to the apparent changes witnessed in the phenomenal world without rejecting Parmenides. They also show the twofold place infinity occupies in that universe.

(1) The fact that physical stuffs are infinitely numerous and varied in kind guarantees that any "coming-into-being" is only apparent (Text I). No such process can ever arise which cannot be reduced to separation and relocation because every physical substance contains an infinity of other substances waiting to be released and organized anew. Here "infinity" seems to signify that no matter how many and how variegated things show themselves to be, there are always others. This is an infinity through addition. As Anaxagoras himself wrote, (Text II, Fr. 3), "there is always a larger than the large." There is no largest: one can always conceive something greater, one can always add (at least, mentally) to any definite sum of things.

(2) The fact that each physical substance is infinitely divisible ensures that even an endless process of division would not cause it to fall into absolute nonbeing. Annihilation is impossible. After any stage in a dividing-process something always remains which can be divided again. Thus, there is no smallest portion beyond which there is nothing (Text II). Always something smaller than what one has arrived at by division remains possible. This remnant would be sufficient to keep the thing in being and would, in fact, contain all other infinitely numerous and varied things. It would, indeed, be "not only infinite but infinite times infinite": it is infinitely divisible and yet each of its portions embraces other things infinite in variety and number.²²⁵ Hence, "in relation to itself everything is both large and small" (Text II, Fr. 3).²²⁶

This double infinity of addition and of division obviously runs parallel to that found in two of Zeno's arguments against plurality and in his

²²⁵ Simplicius, *In Phys.*, 460, 10: (οὐδὲ ἀπειρα μόνον ἀλλὰ καὶ ἀπειράκις ἀπειρα); G, vol. II, 331; Simplicius, *ibid.*, 461, 8: καὶ ἕκαστον, οὐ τῷ πλήθει μόνον καὶ τῷ μεγέθει ἀπειράκις ἀπειρον ἔσται.

Gershenson and Greenberg, *Anaxagoras*, p. 11, look upon this embrace as entailing "infinitesimals": "The only way however that an infinite variety of stable entities can exist in a finite object is for the entities to be *infinitesimal in size*, because an infinite number of entities can be contained in a finite volume only if they are infinitely small." But what is "infinitesimal in size?" "The size of the basic units of matter must be smaller than any finite size, but larger than the size of a point, i.e., that the basic units must be of infinitesimal extension. . . . They were magnitudes whose measure is larger than zero but smaller than any arbitrarily small numbers" (p. 12). See R. Mondolfo, pp. 237-67, especially 251-61. Other scholars see no doctrine of infinitesimals in Anaxagoras' texts.

²²⁶ See G, vol. II, 289.

Dichotomy paradox (see above, pp. 121-24), although each author uses it to attain different results. The insight which underlies Zeno's plurality arguments (Fragments 1 and 3) is that no matter how large a sum one achieves by addition, one can always imagine it larger still. From this Zeno infers that plurality is absurd since such infinity conflicts with things' obvious finiteness. But Anaxagoras applies such an infinity of addition to the number and variety of physical substances and thereby establishes that their generation is nothing but re-organization of pre-existing things. The insight which guides Zeno's Dichotomy paradox is that no matter how small a part one's dividing a quantity according to a fixed ratio may actually have produced, one can always imagine it as divided smaller still. Relying on this, Zeno argues to the impossibility of genuine motion. But Anaxagoras counterbalances the infinite process of division by granting matter infinite divisibility, thereby rescuing material things from any sort of authentic corruption and, eventually, from annihilation.

Rather manifestly, both infinities are common to Zeno and Anaxagoras, but it is a community accompanied by differences. Zeno employs them more directly in reference to mathematical magnitudes so as to disprove plurality and motion. Anaxagoras applies them to physical matter in order to retain some vestige of phenomenal change in an otherwise Eleatic universe.²²⁷

²²⁷ See G. vol. II, 289-90, with references to Gigon and Vlastos; J. E. Raven, "Basis of Anaxagoras' Cosmology," *CQ*, n. s. 4 (1954), 135-37; J. Owens, *Hist.*, pp. 119-20 (where he speaks however of Anaxagoras as entertaining "the mathematical conception of things that was presupposed by Zeno's arguments"); T. G. Sinnige, pp. 126, 135.

Did the two-fold notion of infinity originate with Anaxagoras or with Zeno? D. J. Furley argues with some plausibility that Anaxagoras was the originator and Zeno became aware of it through him: "It is usually assumed that Anaxagoras' theory of the infinite divisibility of matter was an *answer* to Zeno and other Eleatics. I doubt this. Zeno pointed out some of the difficulties in infinite divisibility: if the parts reached have any magnitude at all, the object must be infinitely large – but if they have no magnitude, they cannot contribute anything at all to the sum. It seems to me that Anaxagoras had no answer to this dilemma . . . in fact, even Aristotle had some difficulty in finding one. And it does not seem reasonable that Anaxagoras should blandly take over from Zeno as a prop for his philosophy something that Zeno had shown to be riddled with holes. So I prefer to think that Zeno was answering Anaxagoras" (p. 76). If Furley is right, then the doctrinal sequence is Parmenides, Anaxagoras and Zeno. If the originator of the double infinity theory, Anaxagoras would of course gain in intellectual stature. But see T. G. Sinnige, according to whom (pp. 127-28) Anaxagoras is answering Zeno and yet has intellectual superiority because Anaxagoras' theory of infinity anticipates Bolzano and Cantor (pp. 129-37).

Infinity and Mind

As Simplicius recounts it, Anaxagoras gathered what the primordial state of reality in the universe might have been from his vision into the reality of individual things now.

In Phys., 460, 28; G, vol. II, 331: From the mixture of each thing he [Anaxagoras] arrived at the mixture of all things, for individuals are more manifest and more cognizable by sensation than are wholes.

When he stepped back from singular things, what did he discover primal reality to be? Such is our current question. But we shall trace only those features of his discovery which enable us to understand the functions and nature of Mind. Even here we shall concentrate on its infinity.

As should be clear from the previous section, an individual thing (e.g., bread) is a combination of an infinite number of varied physical substances, each of which is infinitely divisible and each less in quantity and power than the one physical substance which gives the whole its name and its dominant characteristics (see texts in note 223, *supra*). But an individual thing enables one to know the universe, since it is the universe in miniature, it is a microcosm. Hence, the universe in its initial stage was itself an immense but similar single combination, consisting of an infinite number of varied physical stuffs, each of which was infinitely divisible and each less in quantity and power than the material which gives the whole its name and its predominant entitative character.²²⁸ This controlling material was, in fact, an amalgam of air (= mist) and *aither* (= fire) or, to express it through the "opposites" which make them up, of the dense-cold-dark-wet and the rare-hot-bright-dry, since "these are the greatest in the collection of all things both in number and in size."²²⁹ Air and *aither*, as

²²⁸ Fr. 1, Simplicius. *In Phys.*, 155, 26; vol. II, 333: ὁμοῦ χρεῖματα πάντα ἦν ἄπειρα καὶ πλῆθος καὶ μικρότητα κτλ. See J. Kerschensteiner, pp. 140-49.

²²⁹ On dense/rare, etc. see Simplicius, *ibid.*, 156, 5; 156, 29; 179, 1; G, vol. II, 333, 334, 337. In their primal condition the "opposites" apparently would have neutralized one another so that they constituted an inactive and bland mixture. See F. Lämmli, *Vom Chaos zum Kosmos*, p. 47: "Am Anfang stehen für ihn bereits die unendlich vielen Ur-Sachen in einem bestimmten einheitlichen Ur-Zustand, im gleichmässigen, neutralisierenden Gemenge" (also p. 50); F. M. Cleve. *The Giants*, pp. 200-204, where he establishes that "in the beginning the universe or *sympa*... was one, boundless and immeasurable *homoiomeres*" because there was only one kind of molecule or *mereia*, namely, one which "had the combining-ratio 1:1 as to all the *n* elements" (p. 200; author's italics omitted); D. E. Gershenson and D. A. Greenberg, *Anaxagoras*, p. 31. See note 230 *infra*.

On air-*aither* see F. Lämmli, *Vom Chaos zum Kosmos*, p. 48; W. Jaeger, *TEGP*, p. 159; J. Owens, *Hist.*, pp. 114-16; G, vol. II, 294-95.

well as all other physical substances, were there actually and as entitatively distinct from one another.²³⁰ But because this macrocosmic mixture in its primal condition was absolutely motionless,²³¹ because its components were in such small particles and were, moreover, under the control of air-

²³⁰ This actual presence and entitative difference of ingredients in the primal mixture would appear necessary (despite their amalgamation) to avoid any genuine generation from occurring, which would be outlawed by the Parmenidean canons Anaxagoras endorsed (G. vol. II, 297-98; but see C. Bailey, pp. 38, 545-47).

Such presence and difference set Anaxagoras apart from Empedocles, although this is a ticklish point. Empedocles too is post-Parmenidean and, hence, should be trying to avoid any authentic changes from occurring by foregoing identity between the elements. Yet he does say that under the influence of Love the elements are not distinguished in the Sphere (Fragment 27-28; KR 325-26; see above p. 139) and that when Love's power is increasing in the universe "all things come together to be one only" (Fr. 35, 5; G, vol. II, 178). On the other hand, as F. Solmsen points out (*Aristotle's System*, p. 119, n. 7), although "Anaxagoras says [Fr. 1] that in the original condition all things were 'together' . . . , he is careful . . . not to say that they are one." I tentatively conclude, then, that Anaxagoras considered the primal ingredients to be amalgamated but still actually distinct from one another, whereas Empedocles thought of them as so mingled in the Sphere that they become entitatively one and indistinguishable. This difference between Anaxagoras' and Empedocles' views would mean that Empedocles' Sphere is infinite as internally homogeneous (see above, p. 143), while Anaxagoras' universe in its primal state is not infinite in that way. On Anaxagoras and Empedocles, also see F. Solmsen, "Tissues and the Soul," *PR*, 59 (1950), 436-45, especially 440-43; D. O'Brien, "The Relation of Anaxagoras and Empedocles," *JHS*, 88 (1968), 93-113. Also see above, n. 213.

The same actual presence and entitative difference of ingredients also set Anaxagoras apart from Anaximander (see above, pp. 57-58; F. Solmsen, *Aristotle's System*, pp. 118-19), with whom however he agrees on many other points (see G, vol. II, 381 *re* composition of matter; p. 296 *re* organic growth of the universe; p. 301 *re* first stages of cosmogony; p. 320). Also see O. Gigon, "Zu Anaxagoras," *Philologus* 91 (1936-37), 1-41; M. C. Stokes, "On Anaxagoras," *AGPh*, 47 (1965), 245-50; K. von Fritz, "Der *Nous* des Anaxagoras," especially pp. 94-95, 98 (he also compares him with Empedocles and Xenophanes). Theophrastus himself pointed out the similarity between Anaxagoras and Anaximander: "If the mixture of all things is regarded as a single substance, indefinite (*aoriston*) both in form and in size, which is what he appears to mean, it results that he posits two principles, the *apeiron* and the Mind, and so turns out to be describing the corporeal elements similarly to Anaximander" (Simplicius, *In Phys.*, 27, 19; G, vol. II, 330). See J. Kerschensteiner, pp. 155-61, for a comparison of Anaxagoras, Empedocles, Anaximander and Leucippus.

²³¹ According to Aristotle (*Phys.*, 205b1), Anaxagoras himself furnished this explanation of why motion is absent: as *apeiron* the whole mass holds itself fast. It is "contained in itself, for there is nothing else around it, and wherever a thing is, there it is its nature to be. (Therefore, presumably, it is the nature of *apeiron* to be in itself; therefore it supports itself in its existing position)" (G, vol. II, 296, n. 1). F. M. Cleve roots its immobility in the "mutual compensation of two opposite motion tendencies of these *mereias* themselves" (I, 205; author's italics omitted) insofar as each pair of opposites is combined in the ratio 1:1 (p. 201).

aither, which are themselves invisible,²³² all its contents were indiscernible as to kind, shapes, color, flavors.²³³ But this imperceptibility and indistinguishability disappeared when motion was gradually introduced into the universal mixture and parts began to be separated off and to be grouped in larger masses.²³⁴

How did Anaxagoras account for this introduction of motion? After Parmenides no one could take motion for granted: some explanation of it had to be given. Anaxagoras is no exception to this rule. However similar his primal substance is to Anaximander's (see above, n. 230), it was not self-moving. Rather, Intelligence or *Nous* initiated movement in it by causing a small part to rotate at first, a rotation which communicated itself thereafter to increasingly larger areas. Through this motion *Nous* controls and orders all things (organic and inorganic; past, present and future) in the universe.

Fr. 12, Simplicius, *In Phys.*, 156, 21; G, vol. II, 334: Everything that has life, both greater and smaller, all these Mind controls; and it controlled the whole revolution, to make it revolve in the beginning. At first it began to revolve in a small part, but now it revolves over a larger field and will include a larger one still. And the things that are being mingled and those that are being separated off and divided, Mind determined them all. Mind set everything in order, what was to be, what was but is not now, and all that now is and shall be, and this revolution in which revolve the stars, sun, moon, air and fire that are being separated off. This revolution caused the separating off.

This *Nous* which is responsible ultimately for all movement and order in the world – what is its nature? What more can one say than that it is an intelligence? Anaxagoras gives his answer in the lines immediately prior and subsequent to those just quoted.

Simplicius, *In Phys.*, 156, 13 (also see *ibid.*, 164, 24); G, vol. II, 333; KR 372-73: The rest have a portion of everything but Mind is something infinite and independent, and is mixed with no thing, but alone and by itself (νοῦς δὲ ἔστιν ἄπειρον καὶ αὐτοκρατὴς καὶ μέμεινται οὐδενὶ χορήματι, ἀλλὰ μόνος αὐτὸς ἐφ' ἑαυτοῦ ἔστιν). If it were not by itself but were mixed with any other thing, it would have had a share of all things if it were mixed with any, for there is a

²³² See J. Owens, *Hist.*, p. 116. Cleve thinks the invisibility arose because all the elements were combined according to the compensating ration 1:1 (I, 202 and 217).

²³³ See Fr. 4, Simplicius, *In Phys.*, 156, 1; G, vol. II, 333. Instead of Guthrie's "shapes, colours, flavours," F. M. Cleve uses "shapes, surfaces, pleasant sensations" (I, 185-86, 202-203) to translate the Greek words (156, 3: ἰδέας . . . καὶ χοραῖς καὶ ἡδονάς). Also see F. Lämmli, *Vom Chaos zum Kosmos*, p. 51.

²³⁴ The stages of this cosmogony are, I find, best described in A. L. Peck, "Anaxagoras: Predication as a Problem," pp. 118-20; G, vol. II, 294-304.

portion of everything in everything, as I have said before. And the things mixed in it would have prevented it from controlling anything as it can when alone and by itself. It is the finest and purest of all things, and has all judgment of everything and greatest power (λεπτότατόν τε πάντων χρημάτων καὶ καθαρώτατον καὶ γνώμην γε περὶ παντός πᾶσαν ἰσχει καὶ ἰσχύει μέγιστον) No one thing is completely separated or divided from another save Mind. Mind is all alike, both the greater and the smaller.²³⁵

Fr. 14, Simplicius, *In Phys.*, 157, 7 (see emended reading in Berlin edition); G, vol. II, 334; KR 374): Mind, which is forever, is assuredly even now where all other things are also, in the great quantity surrounding and in the things which have been brought together and those which have been separated.

The fact that Mind is unmixed with any of the macrocosmic ingredients determines most, if not all, of its other attributes. That absence of mixture indicates that it is an efficient and not an intrinsic cause of the cosmos. That is, it is present to and within the parts of the universe (Fr. 14) as an agent and not as a constitutive part of them.²³⁶ Because it is not itself an intrinsic part of the universe, it is independent of any of its parts. It moves them all (either directly or indirectly). It knows them all. It controls them all and, thus, it is all-powerful. In fact, one might say it is infinitely powerful since the constituents of the universe which it controls are infinitely numerous, varied and divisible and it is describable in light of them. It is infinite in other ways too. Here one cannot improve upon Guthrie's account (vol. II, 276):

It is *apeiron* in all the main senses of that word: infinite or indefinite in extent, for it is wherever matter is (fr. 14), and that is composed of particles infinite in number (fr. 1 and 2); infinite in time, for it exists for ever (fr. 14); and internally without boundaries, for it is homogeneous, "all alike" (fr. 12 ad fin.).²³⁷

²³⁵ Also see Simplicius, *In Phys.*, 164, 3; G, vol. II, 335.

²³⁶ See above, pp. 64-65. According to T. G. Sinnige Anaxagoras' *Nous* is not a Craftsman deliberately working in accordance with a preconceived plan (pp. 124-26), as Plato and Aristotle have interpreted him. Rather, *Nous* is a descendant of mythical cosmic deities, an ubiquitous force working in the manner of a vital principle in an evolving universe (pp. 121-24, 135-36). Sinnige seems to forget that Anaxagoras' primal cause is an intelligence.

²³⁷ Is Mind immaterial and divine? I agree with G. B. Kerferd's affirmation (PR, 76 [1967], 520) that the *Nous* is "unquestionably material" but, most likely, is a divine substance. Consult references given above, n. 217. Also see J. E. Raven, "Basis of Anaxagoras' Cosmology," pp. 133-34 and 136; D. McGibbon, "The Atomists and Melissus," *Mnemosyne*, 17 (1964), 251 and 253, n. 2; J. Kerschensteiner, p. 145 and n. 6. For an edition of the Greek text, together with Italian translation and commentary, see F. Romano, *Anaxagora* (Padova: CEDAM, 1965), pp. 75-103.

Conclusions

Each individual thing is a composite of constituents infinitely numerous, varied and divisible. The universe itself in its primal state was a similar composite. Mind too is infinite – in power, extent, duration and internal constitution. Obviously, infinity is an important factor in Anaxagoras' *Weltanschauung* – so important, in fact, that it appears to threaten the accuracy of Solmsen's often quoted remark that no Presocratic philosopher except Anaximander made infinity the central and dominating idea in his position ("Anaximander's Infinite," pp. 114-15). But the threat is weakened by the fact that the pivot of the Anaxagorean world-view is that every sort of substance is in every existent (although in diverse amounts) and that any so-called change is nothing more than redistribution of those substances. Infinity is merely a postulate or adjunct of those central realizations.²³⁸ If absolutely all "coming-into-being" or "passing-out-of-being" is to be kept illusory, the basic stuff of the world must be endlessly diverse in nature and be capable of endless division. Let us remember, though, that it is a significant and indispensable adjunct.

THE ATOMISTS

Infinity is likewise a noteworthy adjunct in Leucippus (*fl.* ca. 440-30) and Democritus of Abdera (ca. 460-390), the Presocratic philosophers who are rather commonly acclaimed as most akin to modern scientists.²³⁹ Moreover, these initial atomists were reacting to Parmenides no less than did Anaxagoras. As Guthrie rightly remarks, "atomism is the final, and

²³⁸ Solmsen himself anticipated the threat. Although Anaxagoras introduced "a new variety of the Infinite, the infinitely small," still he converted Anaximander's original proposition so that the *apeiron* became predicate instead of subject. The result was that for him, as for other Presocratics, "it was entities other than the *apeiroi* that occupied the place of the principle . . . ; those who believed in infinity would either attach this concept to one of these other entities or set up some other kind of relationship between the *apeiron* and the pivotal ideas of their system" (*ibid.*, p. 115).

²³⁹ Émile Janssens, *AC*, 36 (1966), 273: "... Atomistes qui représentent la forme de philosophie physicienne la plus audacieuse et la plus étonnamment proche de certaines attitudes scientifiques contemporaines." Also see G, vol. II, 399; S. Sambursky, *Physical World of Greeks*, p. 106; Bailey, pp. 1-2; T. Gomperz, *Greek Thinkers*, I, 327-32.

For dates and data on Leucippus and Democritus, see G, vol. II, 383-89; KR 400-404. I follow Guthrie (and others) in seeing no radical doctrinal differences between Leucippus and Democritus (*vs.* Bailey; T. G. Sinnige, pp. 157-59, 165-66).

most successful, attempt, to rescue the reality of the physical world from the fatal effects of Eleatic logic by means of a pluralistic theory" (vol. II, 389). Let us consider those two points separately, beginning with the second.

Atomists and Parmenides

That the Atomists were reacting to the Eleatics emerges clearly enough from Aristotle's juxtaposing them in his discussion of "coming-into-being" and "passing-out-of-being" in *De Generatione et Corruptione*, 325a2:

[Text I:] Some of the ancients [= Parmenides and his followers] had thought that what *is* must necessarily be one and motionless, since what is void is non-existent, and there could be no motion without a separately existing void, and again there could be no plurality of existents without something to separate them But Leucippus thought he had arguments which would assert what is consistent with sense perception and not do away with coming-into-being and perishing and motion and the plurality of existents. He agrees with sensible appearances to this extent, but he concedes to those who maintain the One that there would be no motion without void, and says that what is void is not-being, and no part of what *is* is not-being – for what *is* in the strict sense is wholly and fully being (τό τε κενόν μὴ ὄν, καὶ τοῦ ὄντος οὐδὲν μὴ ὄν. τὸ γὰρ κυρίως ὄν παμπληθές ὄν). But such being, he says, is not one; there is an infinite number of them (ἄπειρα τὸ πλῆθος), and they are invisible because of the smallness of their mass. They move in the void (for there *is* void [κενὸν γὰρ εἶναι]), and when they come together they cause coming-to-be, and when they separate they cause perishing.²⁴⁰

What does Aristotle tell us in this passage? The fact that the Eleatics deny there is void leads them to infer there is neither motion nor plurality. Being is, therefore, motionless and one. On the other hand, Leucippus grants that plurality and motion do require void, that void is not real, that it is alien to being. Nonetheless, void does exist²⁴¹ and, hence, plurality

²⁴⁰ For translation and Greek text, see Furley, pp. 79 and 80. Also see G, vol. II, 390; KR 404-405; Text X below. For a refusal of Aristotle's accounts as historically accurate on Democritus as reacting to Eleaticism, see T. G. Sinnige, pp. 138-70.

²⁴¹ Leucippus' position is interesting. Void is nonbeing (*mē on*) and is not a part of being, which is marked by fullness (*pamplēthes on*). Yet void *is*. Rather obviously, he distinguishes between "being" or "reality" and "existence." Hence, void is unreal but exists. This conclusion is no mean intellectual accomplishment but there is more. Apparently void for the Atomists is an absence. Hence, to say, "There is void," is similar to saying, "There is darkness," "There is a shadow on the wall," "The man is blind." The Atomists would thus seem concerned with how a negation or privation exists. The only "is" which it has is the "is" of a proposition (e.g., "The man is blind," "It is dark").

On void, see below, notes 243 and 244. For Aristotle's conception of void as a

and motion do also. The last clause needs to be qualified, though. Being retains its characteristics of homogeneity, fullness and compactness ("what *is* in the strict sense is wholly and fully being"); accordingly, it is indivisible or "atomon."²⁴² Being also remains internally unalterable because void is absent from within it ("void is not-being, and no part of what *is* is not-being"). But being is not one but multiple – in fact, infinitely so. There is an infinite number of such beings or "atoms," each of which is invisible because of its small size. Motion is restricted to local motion, exemplified when these atoms come together or separate within the void which "contains" them.

Rather obviously, the Atomists try to honor both Eleaticism and evidence from the sensible universe. To appreciate their endeavour a bit more fully, let us see them in reference to Empedocles and Anaxagoras.

As just indicated by Aristotle, as well as by Parmenides and Melissus themselves,²⁴³ the exclusion of void from reality excluded motion and plurality also. Being is changeless and one. It is compact and full, homogeneous and indivisible. For Empedocles, too, void was unreal, motion and change in a strict sense were impossible, multiplicity did not arise from unity. Yet he did not agree entirely with Parmenides. Reality *is* plurality: the four Empedoclean elements (each of which, though, was like Parmenidean Being because of its homogeneity, qualitative permanence, indestructibility), plus Love and Strife. These last account for the separation and aggregation (the sole kind of "change" allowed) of the elements into the things we perceive. Anaxagoras also considered void to be unreal, authentic change impossible, unity no origin of multiplicity. Likewise, reality is not unity but plurality. What are those plural existents? Here he departed from Empedocles (and, of course, from Parmenides). They are infinitely varied in kind, each of which contains some amounts of all others and each infinitely divisible. Not Love and Strife but a cosmic Mind is responsible for the only sort of "change" permitted. Itself infinite in extent, duration, power and internal constitution, Mind initiates the dislocation and relocation of those endlessly varied physical substances, processes which culminate in the world we experience.

In their response to Eleaticism, Leucippus and Democritus take quite

place without body and in contrast with the Atomists, see F. Solmsen, *Aristotle's System*, pp. 135-43.

²⁴² G, vol. II, 395, n. 3.

²⁴³ According to Furley, p. 80, "The argument that the non-existence of void entails the impossibility of motion belongs to Melissus, certainly, and probably to Parmenides." Also see G, vol. II, 33-34 and 391; Tarán, pp. 100-101, 110-13, 154; J. Kerschensteiner, pp. 155-61.

an independent stand. There is void in the universe (*vs.* Empedocles and Anaxagoras); its presence helps explain the presence too of local motion and the separation of multiple existents.²⁴⁴ Of what does multiplicity consist? Of an infinite number of units (*vs.* Empedocles; see below, Texts IV, V, VIII, IX, X, XI), which are identical in nature (Text III) and undifferentiated as to qualities and other sensible properties (with Parmenides, *vs.* Anaxagoras).²⁴⁵ No such unit is infinitely divisible (*vs.* Anaxagoras); rather each is indivisible because of its smallness, compactness, impassibility, inner freedom from void (with Parmenides; Texts IV, VI, VII, VIII, IX).²⁴⁶ Consequently, reality now consists basically of an infinite number of "atoms," which have gathered together haphazardly (*vs.* Anaxagoras) into the relatively stable and varied combinations we name "man," "tree," "cow," "rock" and so on (Texts IV, IX, XI). Motion needs no extrinsic cause (*vs.* Empedocles and Anaxagoras): it is an inherent and unending characteristic of lifeless matter in the infinite expanse of empty space (Texts IX, X, XI).²⁴⁷ Our world, which is only one among innumerable others (both simultaneous and successive), resulted from precisely that sort of eternal, random and mechanical movement, which will eventually disintegrate it too (Text XII).²⁴⁸

[Text II:] Aristotle, *Meta.*, 985b4 (G, vol. II, 392-93; KR 406-407): Leucippus and his associate Democritus name plenum and void as elements, calling them "being" and "not-being"; the full and solid is being, the empty and rare is not-being. Hence they say that being exists no more than not being, because void exists no less than body (διὸ καὶ οὐθὲν μᾶλλον τὸ ὄν τοῦ μὴ ὄντος εἶναι φησιν, ὅτι οὐδὲ τὸ κενὸν [ἐλαττον] τοῦ σώματος) They too say that the differences [*sc.* in the atoms] are responsible for everything else. These according to them are three: shape, arrangement and position.

[Text III:] *De Caelo*, 275b30 (after the Oxford and Loeb translations; see also G, vol. II, 393): If the whole is not continuous but exists, as Democritus and Leucippus

²⁴⁴ On void, see above, Text I and note 243, as well as *infra*, Texts II, III *in initio*, IX, X *ad finem*. On the *ouden/den* ("nothing"/"hing" or void/being) couplet in Text IX, see G, vol. II, 392, n. 3. To the references given there on the controversy between Moorhouse and Matson on the couplet, add: D. McGibbon, "The Atomists and Melissus," *Mnemosyne*, 17 (1964), 248-55.

For comments on how Empedocles and Anaxagoras denied the void but affirmed locomotion (possibly) through reciprocal replacement, see G, vol. II, 147, n. 1 and 398; F. Solmsen, *Aristotle's System*, p. 142.

²⁴⁵ See G, vol. II, 393; Furley, pp. 127-28; F. Solmsen, *Aristotle's System*, pp. 120-21. Differences in atoms are due to their shape, arrangement and position: see Texts II *ad finem*, VIII, IX and XI. On infinity of atomic shapes, see texts V, VII and IX; also see below, "Infinity."

²⁴⁶ See Furley, pp. 94-96, and below, "Indivisibility."

²⁴⁷ See G, vol. II, 396-404; Bailey, pp. 129-35.

²⁴⁸ See G, vol. II, 404-413; KR 409-413; Bailey, pp. 90-101 and 138-48.

think, in the form of parts separated by void, there must necessarily be one movement of all the multitude. They are distinguished, we are told, by their shapes, but their nature is one (διώρισται ... τοῖς σχήμασιν· τὴν δὲ φύσιν ... αὐτῶν μίαν), like many pieces of gold separated from one another. But each piece must, as we assert, have the same motion.

[Text IV:] *Ibid.*, 303a5 (KR 416 and 421; also Oxford and Loeb translations): They [Leucippus and Democritus] say that their primary magnitudes are infinite in number and indivisible in magnitude (τὰ πρῶτα μεγέθη πλήθει μὲν ἄπειρα μεγέθει δὲ ἀδιαίρετα); the many does not come from one nor one from many, but rather all things are generated by the intertwining and scattering around of these primary magnitudes.

[Text V:] *Ibid.*, 303a11 (KR 421; Loeb and Oxford translations): Further, they say that since the atomic bodies differ in shape and there is an infinity of shapes, there is an infinity of simple bodies (ἄπειρα δὲ τὰ σχήματα, ἄπειρα καὶ τὰ ἀπλᾶ σώματα). But they have never explained in detail the shapes of the various elements, except so far as to allot the sphere to fire.

[Text VI:] *Ibid.*, 303a20 (Furley, p. 87): Moreover, they must be in conflict with mathematics when they say there are indivisible bodies (ἄτομα σώματα), and rule out many common opinions and sensible phenomena.

[Text VII:] *Ibid.*, 306a26 (Furley, p. 88): They are compelled to deny that every body is divisible (πᾶν σῶμα ... διαίρετόν), and so to be in conflict with the most exact sciences. For the mathematical sciences take even the *intelligible* to be divisible, whereas these philosophers do not even allow that every *sensible* body is divisible, in their anxiety to save their theory. For all those who allot a shape to each of the elements and distinguish their natures by shapes are compelled to say that they are indivisible, since when a pyramid or a sphere is divided in some way the remainder is not a sphere or pyramid.

[Text VIII:] Aristotle, *De Generatione et Corruptione*, 314a21 (Oxford translation): Democritus and Leucippus say that there are indivisible bodies, infinite both in number and in the varieties of their shapes (ἐκ σωμάτων ἀδιαίρετων ... ταῦτα δ' ἄπειρα καὶ τὸ πλῆθος ... καὶ τὰς μορφάς), of which everything else is composed – the compounds differing one from another according to the shapes, positions, and groupings of their constituents.

[Text IX:] Aristotle, *On Democritus* (see Simplicius, *In De Caelo* 294, 33; DK 68A37 (Rose Fr. 208); Oxford translation): Democritus thinks the nature of the eternal entities consists of small substances infinite in number; as a place for them he supposes something else infinite in size, and to this he applies the names “the void,” “nothing” and “the infinite,” while each individual atom he calls “hing” [= “nothing” without “not”], the “compact” and “being” (τὴν τῶν ἀδίδων φύσιν εἶναι μικρὰς οὐσίας τὸ πλῆθος ἀπείρου· ταύταις δὲ τόπον ἄλλο ὑποτίθησιν ἄπειρον τῷ μεγέθει, προσαγορεύει δὲ τὸν μὲν τόπον τοῖσδε τοῖς ὀνόμασι, τῷ τε κενῷ καὶ τῷ οὐδενὶ καὶ τῷ ἀπείρῳ, τῶν δὲ οὐσιῶν ἐκάστην τῷ δὲν καὶ τῷ ναστῷ καὶ τῷ ὄντι). He thinks that they are so small as to elude our senses, but they have all sorts of forms and shapes and differences in size. So he is already enabled from them, as from elements, to create by aggregation bulks that are perceptible to sight and the other senses. They struggle and move in the void because of the dissimilarities between them and the other differences already mentioned; and as they move they collide and become entangled in such a way as

to cling in close contact to one another, but not so as to form one substance of them in reality of any kind whatever; for it is very simple-minded to suppose that two or more could ever become one. The reason he gives for atoms staying together for a while is the intertwining and mutual hold of the primary bodies; for some of them are angular, some hooked, some concave, some convex, and indeed with countless other differences; so he thinks they cling to each other and stay together until such time as some stronger necessity comes from the surrounding and shakes and scatters them apart.

[Text X:] Simplicius, *In Phys.*, 28, 7 (KR 400): For while they [Parmenides and Xenophanes] regarded the whole as one, motionless, uncreated and limited and forbade even the search for what is not, he [Leucippus] posited innumerable elements in perpetual motion—namely the atoms—and held that the number of their shapes was infinite (ἐκείνων γὰρ ἓν καὶ ἀκίνητον καὶ ἀγέννητον καὶ πεπερασμένον ποιούντων τὸ πᾶν, καὶ τὸ μὴ ὄν μὴδὲ ζητεῖν συγχωρούντων, οὗτος ἄπειρα καὶ αἰεὶ κινούμενα ὑπέθετο στοιχεῖα τὰς ἀτόμους καὶ τῶν ἐν αὐτοῖς σχημάτων ἄπειρον τὸ πλῆθος), on the ground that there was no reason why any atom should be of one shape rather than another; for he observed too that coming-into-being and change are incessant in the world. Further he held that not-being exists as well as being (οὐδὲν μᾶλλον τὸ ὄν ἢ τὸ μὴ ὄν), and the two are equally the causes of things coming-into-being. The nature of atoms he supposed to be compact and full; that, he said, was being, and it moved in the void, which he called not-being and held to exist no less than being ([τὸ κενόν] μὴ ὄν ἐκάλει καὶ οὐκ ἔλαττον τοῦ ὄντος εἶναι). In the same way his associate Democritus of Abdera posited as principles the full and the void.

[Text XI:] Simplicius, *In De Caelo*, 242, 18 (KR 407 and 419): They [Leucippus, Democritus, Epicurus] said that the first principles were infinite in number, and thought they were indivisible atoms and impassible (ἀπείρους . . . τῷ πλήθει τὰς ἀρχὰς ἅς καὶ ἀτόμους καὶ ἀδιαίρετους . . . καὶ ἀπαθεῖς) owing to their compactness, and without any void in them; divisibility comes about because of the void in compound bodies. These atoms move in the infinite void (ἐν ἀείρῳ τῷ κενῷ), separate one from the other and differing in shapes, sizes, position and arrangement; overtaking each other they collide, and some are shaken away in any chance direction, while others, becoming intertwined one with another according to the congruity of their shapes, sizes, positions and arrangements, stay together and so effect the coming into being of compound bodies.

[Text XII:] Diogenes Laertius, 9, 30 (G, vol. II, 406; KR 409-410): Leucippus holds that the whole is infinite (τὸ μὲν πᾶν ἄπειρον) . . . Part of it is full and part empty, and these he calls elements. Worlds unlimited in number (κόσμους . . . ἀπείρους) are formed from these and dissolved into them. The manner of their formation is this. Many bodies [= atoms] of all sorts of shapes are cut off from the infinite (ἐκ τῆς ἀείρου [χώρας]) and stream into a great void, and these when collected in a mass produce a single vortex, following the motion of which they collide and revolve in all sorts of ways and begin to be sorted out, like to like. [Etc.] . . . Just as a cosmos is born, so also it grows, declines and perishes by some sort of necessity.

The previous texts have been brought together (although in an admittedly awkward way) so that one may realize why Leucippus and

Democritus are post-Parmenidean authors and how their reaction differs from that of Empedocles and Anaxagoras. They also furnish data on infinity. Before taking up that topic, though, let us briefly consider indivisibility, which will help towards a better understanding of infinity.

Indivisibility

Leucippus and Democritus are called atomists precisely because, in contrast with Anaxagoras' theory of matter as infinitely divisible and under the influence of Zeno's claim that endless division entails absurdity, they conceived the basic units of matter as "atoms," as "indivisibles."²⁴⁹ But how indivisible are such units? How atomic are the atoms? Only physically or also mathematically and logically? Such are the questions confronting us now. Let us work out an answer by sampling the attitudes a few others have recently taken.

The final pages of Volume II of W. K. C. Guthrie's *History of Greek Philosophy* are an appendix, "Indivisibility and the Atoms," pp. 503-507. After stating that "the evidence is complicated and sometimes conflicting," Guthrie adds, "I make no claim to be saying the last word on it" (p. 503). What is his provisional conclusion? He states that it conflicts with that of Gregory Vlastos (he gives no references, though) and of S. Luria, "Die Infinitesimallehre der antiken Atomisten," *Quellen und Studien zur Geschichte der Mathematik*, 2 (1933), 106-185. As Guthrie reads him, Vlastos infers "that the atoms of Democritus are indivisible for physical reasons, but infinitely divisible as portions of the three-dimensional extensive continuum, i.e., if regarded mathematically" (vol. II, 503). On the other hand, Luria

supposes that there were two kinds of atom. The one, out of which the physical world is built up, is physically indivisible because of hardness, solidity and so forth, but actually has parts and is therefore mathematically divisible. The other is mathematically indivisible because without parts (*amerēs*). "Atoms" of the first kind... are divisible into those of the second (p. 504).

In contrast to those two authors, Guthrie considers that "the atoms were for Leucippus and Democritus without parts, logically as well as physically indivisible, although each was a physical body possessed of a certain magnitude. The infinite divisibility of matter was inconceivable" (p. 503). Such thorough indivisibility was the only way these early Atomists could

²⁴⁹ Furley (pp. 21, 63-78) attaches considerable importance to Zeno's "puzzles of divisibility," as we shall see below.

satisfy "the Eleatic (and especially Parmenidean) canons of unity. What is one must be free from any possibility of change, not susceptible to addition or subtraction, a plenum, continuous and indivisible. It is a single whole, without parts" (*ibid.*). Leucippus and Democritus made each atom be precisely such a unit, incapable of physical or even of mathematical division.

Also in 1965 Gregory Vlastos published a significant but difficult paper, "Minimal Parts in Epicurean Atomism," *Isis*, 56 (1965), 121-47. As its title reveals, the paper is concerned with Epicurus (ca. 341-270). But it merits attention because Epicurean atomism illumines by way of contrast that of Leucippus and Democritus a full century earlier. Some contrasts Vlastos himself draws. The early Atomists "had maintained that (I) every kind of atomic size and (II) every kind of atomic shape exists in nature" because of their principle that "every possibility is realized in nature unless there is a definite reason to the contrary." But "Epicurus, a much more self-conscious empiricist, would attach an emphatic rider: 'but only if its occurrence agrees with the phenomena better than would its nonoccurrence'" (p. 139). Since the phenomenal world does not need endlessly varied sizes and shapes in atoms, Epicurus concluded there are some but not infinite varieties. In his own words (as translated by Vlastos, p. 140):

We must not believe that *every* size exists among the atoms, so that the phenomena may not contradict us. We must believe that there are some variations of size: [A] For if this is the case we can give a better account of what we experience and observe by the senses. But the existence of every size is of no use [for accounting] for the differences of the qualities. [B] At the same time [i.e. on the same hypothesis] atoms which are [large enough to be] visible should have reached us; and this is not observed to happen nor is it possible to conceive how an atom could become visible.²⁵⁰

But elsewhere Vlastos concentrates on Epicurus with fewer explicit references to Leucippus and Democritus. The core of his concern is this sentence from Epicurus, *Epistle to Herodotus*, # 59 (Vlastos' translation, p. 136): "We must regard these partless minima as limits of lengths,

²⁵⁰ Concerning the cogency of the last sentence of the translated text (# B), Vlastos asks why there could not be an infinite number of atomic sizes below the threshold of visibility. "There certainly could be," he answers, "on either of two possibilities. . . . [1] There might be infinitely many atomic sizes between any given size, X, and zero. . . . [2] There might be infinitely many atomic sizes intermediate between any two unequal sizes, X and Y" (pp. 140 and 142; author's italics omitted). In Vlastos' estimation Epicurus eliminates the first by pressing into service Zeno's argument vs. plurality preserved in Fragment 1 (p. 141). He eliminates the second by "his famous argument by analogy from the 'minimum in sensation' to 'the minimum in the atom'" (p. 143; see entire discussion, pp. 143-45).

providing from out of themselves as primary units, the measure of the greater and lesser for the rational apprehension of the indivisibles." What are those "partless minima" in the atom of which Epicurus speaks? One plausible answer is that they are "physically indivisible elements" (p. 121). But this will not do since "the primary elements which were *defined* as indivisibles, and even so *named*, were the atoms. Why then should he want to lodge a new set of indivisibles inside each of the old ones?" Rather, "for Epicurus the atom is unalterability itself, the bedrock on which the invariance of the laws governing natural change can safely rest." As he himself says (*Epistle to Herodotus*, #41-#42): "Some bodies are compounds, others [are the elements] from which compounds are made. And the latter must be uncuttable (*atoma*) and unchangeable, if all things are not to perish into not-being, but have the power to endure through [any] dissolutions of the compounds, so full [i.e. solid] in nature that at no point in no way can they be dissolved" (p. 122).

Another plausible reply is that the "partless parts" of the atom are "mathematically indivisible magnitudes" (p. 123), which geometry would recognize as its smallest admissible magnitudes. This view has capably been proposed by S. Luria and, more recently (although with some reservations), by Jürgen Mau.²⁵¹ Nonetheless, it encounters an insuperable difficulty. Mathematically indivisible magnitudes would need a finitist geometry, which was then non-existent. The only sort of geometry available dealt solely with infinitely divisible magnitudes (pp. 125-35).

If neither of those answers is acceptable, what substitute does Vlastos himself offer? His position is that "the minima to which Epicurus refers at 59 are not intended to function as mathematical indivisibles but simply as physical quanta" (p. 138, n. 86 *ad finem*). They are physical parts of a unique sort, though – the sort which figure in the definition Euclid gives at the beginning of Book V: "A magnitude is a *part* of a magnitude, the less of the greater, when it measures the greater" (p. 136). They provide a measure, not as a unit of measurement but as submultiples of the quantity measured (p. 137). What Epicurus intends in the passage under study is "not to recommend a convenient minyardstick to hypothetical atomometrists, but to propound a truth about atoms, a law of nature, . . . a physical statement about the atoms," which may be expressed as follows: "Atoms are so constituted that variations in atomic lengths occur only in integral multiples of the smallest atomic length" (p. 138).²⁵² How does he

²⁵¹ *Zum Problem des Infinitesimalen bei den antiken Atomisten* (Berlin: Akademie-Verlag, [2nd ed.] 1957).

²⁵² Vlastos complements this law by a second, more directly derived from

establish this "law of nature"? He uses "his famous argument by analogy from the 'minimum in sensation' to 'the minimum in the atom'." Assuming that "things must have a minimum size, if they are to be sensed at all," he infers that "sensibilia of larger size must be integral multiples of it." He then argues that if the inference "is true of the perceived, a similar truth must hold of the unperceived: if all sensibilia are 'measured' by a minimum sensible quantity, then all atoms must be 'measured' by a minimal physical quantity" (p. 143). This last, which might be designated as atomic length q plays an analogous role to that of the first integer in Greek arithmetic. The unit "measures all numbers, including the primes . . . but no other number measures it." So too each of the minima is "an atomic length which is a submultiple of all other atomic lengths, but there is no other atomic length which is a submultiple of theirs." Hence, each such atomic length is "partless" because there is no other atomic length which can be part of theirs, while theirs can be part of any other atomic length. What, then, is the "smallest thing in the atom," its "partless" part? According to the Epicurean law of nature, it is the smallest atomic length in existence which has no other atomic length as a part (p. 146). Although physically indivisible, it is mathematically divisible since there is nothing in that law "to entail that q is the smallest possible linear magnitude in geometry" (p. 147).

The final author to be noted is David J. Furley, who published in 1967 a significant and lengthy study entitled, *Indivisible Magnitudes*.²⁵³ Like Vlastos he is concerned with Epicurus (although not exclusively, as we shall see), editing the Greek text of *Letter to Herodotus*, sections 56.5-59, with translation and commentary (pp. 7-27); comparing his doctrine with Lucretius' (pp. 28-43); seeing him in relationship to Aristotle (pp. 111-30), Diodorus Cronus (pp. 131-35) and David Hume (pp. 136-47). He is, of course, aware of Vlastos' article in *Isis* but finds it somewhat unacceptable.

Lucretius and stating the limits of variations for atomic shapes: "Atoms are so constituted that variations in their shapes occur only in permutations of a modular unit of invariant size and shape." What shape? None is specified but, Vlastos adds: "I know of no good reason for questioning the usual assumption . . . that it would be the simplest of all modular units for three-dimensional magnitude, a cube" (p. 138, n. 87).

²⁵³ This is the first of two papers in a book we have already referred to frequently: David J. Furley, *Two Studies in the Greek Atomists. Study I: Indivisible Magnitudes; Study II: Aristotle and Epicurus on Voluntary Action* (Princeton, New Jersey; Princeton University Press, 1967). The first study runs pp. 3-160. It is receiving favorable reviews – for example, see Robert Joly, *AC*, 36 (1967), 725-26; John M. Rist, *Phoenix*, 21 (1967), 232-33. Also see D. J. Furley, "Aristotle and the Atomists," pp. 85-91.

Granted that the "*minimae partes* necessarily have . . . the properties which Vlastos gives them."²⁵⁴ Granted also that "Epicurus uses them in his polemic against infinite variety of atomic size and shape. But that is not the whole, or the essential point, of the theory" (p. 21). Epicurus' doctrine was a modification, under the sting of Aristotle's criticism, of a position "which the earlier atomists put together to meet and thwart the Eleatic attack on pluralism," launched especially through Zeno's puzzles about divisibility. Vlastos' interpretation does not do justice to this aspect of it. Granted, then, that "all atoms contain an integral number of parts of uniform dimensions. These parts are distinguishable only theoretically. But he [Vlastos] asserts that they are theoretically [= mathematically] divisible, whereas I believe them to have been theoretically indivisible, since only on this assumption do they serve their purpose of circumventing the Eleatic divisibility puzzles" (*ibid.*).

In order to understand Furley's view better, let us turn to his historical survey. Although both Parmenides and Melissus figure in this history (see pp. 57-62), its most important stage is probably the arguments of Zeno (p. 63), especially the argument against plurality preserved in Fragment 1 (Simplicius, *In Phys.*, 139, 18; Furley, p. 64, for Greek text and translation). After minutely examining this argument,²⁵⁵ Furley judges Zeno to be pointing out "some of the difficulties in infinite divisibility: if the parts reached have any magnitude at all, the object must be infinitely large – but if they have no magnitude, they cannot contribute anything at all to the sum" (p. 76).²⁵⁶ How might one escape the antinomy? One way is by asserting that magnitude is, ultimately, indivisible rather than divisible, and this is the route taken by Leucippus and Democritus (pp. 79-101). In their eyes reality consists of an infinite number of extended "indivisibles" or "atoms," which are such because they are "absolutely solid, packed with being and nothing else. There is no void, or not-being, in an atom; hence nothing can penetrate it, so as to divide it" (p. 99). But how indivisible is an atom – physically or also theoretically? Since Being to

²⁵⁴ His explanation of Vlastos' position is clearer than that given by Vlastos himself: "Vlastos argues that in our passage [*Letter to Herodotus*, #58] Epicurus asserts only that there is a smallest atomic length (i.e., a length than which no atom is smaller) and that all atoms are integral multiples of it. That is to say, any atom is of one of the following sizes: q , $2q$, $3q$, . . . nq . It is a matter of fact (according to this interpretation of Epicurus) that no atom is smaller than q , and that there is no atom of, say $3q/2$ units" (p. 21).

²⁵⁵ See Furley, pp. 65-69. Also see above, pp. 121-23.

²⁵⁶ According to Furley (*ibid.*), Zeno is here attacking Anaxagoras' theory of infinite indivisibility. See above, pp. 148-49 and n. 227.

Parmenides and to Melissus is characterized by theoretical indivisibility, since "Zeno's arguments have usually been taken as bearing on *mathematical* [and not merely physical] problems of divisibility," since Leucippus and Democritus are endeavoring to cope with those three Eleatics, the atoms must be both physically and theoretically indivisible. "A physically un-splittable atom which is still theoretically divisible will not meet the Eleatic arguments at all" (p. 86; also see pp. 127-28).

Another solution of Zeno's antinomy is that offered by Aristotle. Magnitude is infinitely divisible, but potentially and not actually. This is a potentiality, though, which can never be realized fully or all at once. Rather it consists in a process in which the number of parts actually achieved through division is finite, each of which is however always capable of further division. Hence, infinite divisibility of this sort does not entail that a magnitude contains an actual infinity of parts or is infinitely large (pp. 128, 148-54; see above, pp. 120-21). Aristotle's answer disarmed Zeno and likewise, "made the [Atomists'] theory of indivisible magnitudes *unnecessary*. But he also tried to prove it false" (p. 128), an attempt which provoked Epicurus' doctrine that there are physical atoms which nonetheless contain indivisible parts (p. 111).

One of Aristotle's attempts occurs at the beginning of *Physics Z*, where he argues that if there were indivisible units of extension, no continuity would be possible. "It is impossible for anything continuous to be made of indivisibles, e.g. for a line to be made of points: for two things are said to be continuous 'if their extremities are one,' and points *have* no extremities. It is impossible to distinguish the extremity from another part of an indivisible" (p. 114). Epicurus rejoined by claiming that extremities, whether of a physical or of an atomic body, do have dimensions. "You can *see* the extremity of a physical body; but you can only see what has physical existence; hence the extremity of a visible body has physical existence, and therefore has dimensions. By analogy, you can infer that the same is true of 'the things you cannot see,' i.e. the atoms; they too have extremities which have dimensions" (p. 115). Such indivisible units as these extremities or surfaces can form a continuum, although their contact is neither that of a whole with whole nor of part with part but of units of measurement. "They have no parts, in the sense that they cannot be divided into units having smaller dimensions, [but] this does not entail that there is *no* distance between one surface of his unitary solid and another" (pp. 115-16). Surfaces of an atom, then, are its indivisible parts, its "partless" parts. They are its minima, which are not points without magnitude but units of minimum extension (p. 128) and which he chose

to make "into *parts* of atoms, and not into the atoms themselves" (p. 129).²⁵⁷ They are, in Epicurus' own words (*Letter to Herodotus*, # 59), "the minimum partless limits . . . providing for larger and smaller things the standard of measurement of their lengths, being themselves the primary units, for our use in studying by means of thought these indivisible bodies" (p. 25). Although an atom is theoretically divisible (i.e., "parts can be distinguished within it by the mind, even if the parts can never be separated from each other by a spatial interval"; p. 4), these its minimal parts are indivisible both physically and theoretically: Parmenides' and Melissus' championing indivisibility and Zeno's attacks on divisibility seem to allow no other interpretation.²⁵⁸

Having interviewed Guthrie, Vlastos and Furley, what shall we ourselves say on indivisibility? Let us begin with Epicurus and work backwards. In opposition to Aristotle's theory of potentially infinite divisibility, he insisted that magnitudes must, ultimately, be indivisible for at least three reasons. Infinite divisibility would mean that the size of any infinitely divisible body is itself infinite, "for obviously the infinite parts must be of *some* size, and whatever size they may happen to be, the size [of the total] would be infinite" (*Letter to Herodotus*, # 57, C 1; Furley, p. 14). It would entail that we are capable of "reaching infinity in thought," a capability which we lack (*ibid.*, # 57, C 2; Furley, p. 16). It would eliminate stability both in nature (things deprived of ultimates would "crumble away into nothingness") and in our knowledge of them (*ibid.*, # 56; Furley, pp. 12-13 and p. 154).

There must, then, be ultimates which are indivisible and totally so – that is, not only physically but also theoretically (*seu* mathematically, logically, etc.). Such complete exclusion of division appears demanded by the three reasons just listed, as well as by Eleatic influence on Epicurus (with Guthrie, Furley). But where are those ultimates to be found? What, precisely, are they? For Epicurus they are not the atoms themselves.

²⁵⁷ Epicurus made this choice, according to Furley's "reasonable guess" (p. 129), because of "Aristotle's careful analysis of the geometry of motion," which "made it clear that the distance traversed by a moving body must be composed of indivisible minima, if there are indivisible magnitudes at all" (*ibid.*). Also see G. E. L. Owen, "Zeno and Mathematicians," pp. 148-52, 156-63.

²⁵⁸ But what of Epicurus and geometry? Did he reject it, substitute another, or remain indifferent to it? In view of his philosophical position one "would expect . . . that Epicurus would regard geometry as irrelevant to the study of nature, because one of its essential principles (that of infinite divisibility) was contrary to the facts of nature" (p. 156). Confronted with a choice between infinite divisibility and minimal parts, he opted for the latter and "made no attempt, apparently, to work out a fully systematic mathematical theory to support his physics" (p. 157).

Under pressure of Aristotle's objection against earlier Atomists that indivisible units of extension, time and motion destroy the continuum and motion (see Furley, pp. 111-121, especially 121), he affirmed that atoms contain parts: the atomic surfaces, which have length, breadth and minimal depth (Furley, p. 6). These minima are the ultimates. They are themselves partless not only because (with Vlastos, p. 146) they are each "an atomic length which is a submultiple of all other atomic lengths but... no other atomic length... is a submultiple of theirs" but also because (with Furley, pp. 115-16) they cannot be divided into units having smaller dimensions. They are theoretically, as well as physically, indivisible. Because of them, though, the atoms themselves are physically indivisible but theoretically divisible.

A full century earlier Leucippus and Democritus were free from the Aristotelian pressure which Epicurus felt. Accordingly, their atomism was simpler, less sophisticated, perhaps more consistently atomic than the Epicurean version. As Furley aptly remarks, "The theory of minima was not originally part of the argument for the *existence* of physical atoms.... It was not intended to solve the same kind of problem as physical atomism. If anything, one would have expected it to be a stumbling-block to a theory of physical atoms" (p. 41). The problem which they faced was how to do justice to the obvious multiplicity and movement of the sensible world, while simultaneously respecting the Eleatic canons on reality. As we have already seen, their solution was to combine within one and the same theory void and being (see above, Texts I, II, IX). Void guaranteed motion and the separation needed for multiplicity. Being consisted in homogeneity, simplicity, fullness, compactness, unalterability – in a word, indivisibility. The result: an affirmation that reality is an infinite number of indivisible beings or "atoms," moving eternally and mechanically in infinite void. But how indivisible are the atoms – physically or also theoretically? The explicit information provided by the sources on Leucippus and Democritus concerns only the fact that the ultimate beings are indivisible (Texts IV, VI, VII and VIII) and the reason why (for example, Text XI: "... indivisible atoms and impassible, owing to their compactness, and without any void in them"). That they must be totally indivisible is an inference, well justified, from Eleatic influence. As the first Atomists conceived them, then, atoms would be even theoretically indivisible (with Guthrie and Furley).²⁵⁹

²⁵⁹ The questions of where the ultimate units of indivisibility are to be found and of how indivisible they are remain a constant throughout the history of atomism. See Andrew G. Van Melsen, *From Atomos to Atom: The History of the Concept*

Infinity

Let us now take up the question previously mentioned but postponed: what role does infinity play in atomism? The fact that atoms are indivisible eliminates one sort of infinity, obviously: that issuing from endless divisibility, which was proposed by Anaxagoras, ridiculed by Zeno and promoted anew by Aristotle. That elimination is simultaneously an acceptance of definiteness (and, thus, of limit and finitude) in entity and in knowledge. Reality never changes radically but always remains what it was and is: indivisible units of single-natured, homogeneous, solid, unalterable and, thereby, Eleatic being. It can consequently ground definite and sure knowledge.

But Leucippus and Democritus are not Parmenides for all of that. Although each unit is Eleatic in its entitative characteristics, still there are many such units. They are, in fact, infinite in number (see above, Texts I, III, V, VIII, IX, X, XI) and infinite in variety of shapes also (Texts V, VIII, X). Moreover, the field within which they move is infinite void (Texts X, XI), in which infinite worlds occur (Text XII). An infinitude of atoms coalescing into innumerable worlds within an infinitude

"Atom" (Pittsburgh: Duquesne University Press, 1952); *idem*, "Atomism," *EP*, I, 193-98; L. L. Whyte, *Essay on Atomism from Democritus to 1960* (New York: Harper and Row, 1961). In modern times an atom, as conceived by Rutherford and Bohr, "consists of a nucleus around which one or more electrons move in different orbits In one atom there are as many electrons as there are units of positive electricity in the nucleus" (Van Melsen, *From Atomos to Atom*, p. 171). Obviously such an atom is not partless or indivisible. In fact the nucleus itself entails neutrons, electrons and protons, as well as neutrinos, mesons and so on (*ibid.*, pp. 180-85). In general, the concept "smallest particle" has a relative meaning (*ibid.*, pp. 189-90). If used absolutely, it might point possibly to a frequency of light (*ibid.*, p. 176). Also see C. F. von Weizsäcker, *The World View of Physics*, transl. Marjorie Grene (Chicago: University of Chicago Press, 1952), pp. 37-57 and 75-83.

The difficulty of intellectually penetrating matter thoroughly enough to find the ultimate indivisible units suggests another line of reflection. If in the last analysis reality is tightly connected with indivisibility, why not exclude division altogether? Then there would not be many indivisible units but one only; the underlying indivisible stuff which is the core of reality. Parmenides would call it Being. Contemporary physicists might call it Energy. See Werner Heisenberg, *The Physicist's Conception of Nature*, transl. Arnold J. Pomerans (New York: Harcourt, Brace and Company, 1958), p. 46: "All particles are basically nothing but different stationary states of one and the same stuff. Thus even the three basic building-stones [protons, neutrons and electrons] have become reduced to a single one"; L. L. Whyte, *Essay on Atomism*, p. 102: "A relativistic field theoretician . . . may hold that the primary phenomenon is a relational field of energy and that apparent discreteness is a secondary and transitory effect arising only in special circumstances." At any rate atomism would seem to retain its character of indivisibility and, hence, of atomism better if it is a monism rather than a pluralism.

of space adds up to a sum of things, a totality, an All which is itself infinite (Text XII: τὸ μὲν πᾶν ἄπειρον).

What do Leucippus and Democritus wish to signify by classifying all those factors (number, shapes, void, *cosmoi*, the whole) as *apeiron*? It is not an easy question. In the *Physics*, Book III, chs. 4-5, Aristotle used their position (as well as others) to provide a context within which to propose his own theory that infinity is aligned with potentiality (chs. 6-7; see above, pp. 120-21). This usage might suggest that theirs was linked with actuality, that they intended atoms, shapes and so on to be actually infinite. "Those philosophers of nature," Aristotle argues in 203a18 sq., "who make the elements limited in number, never make them infinite in amount. But those who make the elements infinite in number, as Anaxagoras and Democritus do, say that the infinite is continuous by contact."²⁶⁰ The continuum or "common body" (*ibid.*, 203a33) which an infinite number of elements or atoms constitute would presumably be actually infinite in extent. When shortly afterwards he lists five reasons why people believe the infinite exists, he comments upon the fifth (namely, that some things "never give out in our thought") as follows (203b25-30):

The last fact (that what is outside [the heaven] is infinite) leads people to suppose that body also is infinite, and that there is an infinite number of worlds. Why should there be body in one part of the void rather than in another? Grant only that mass is anywhere and it follows that it must be everywhere. Also, if void and place are infinite, there must be infinite body too, for in the case of eternal things what may be must be.²⁶¹

The infinite body which develops into infinitely numerous worlds and which presumably is constituted by atoms infinite in number and shapes seems identical with the infinite continuum or "common body" of the previous text. It would, then, be actually infinite in extent according to Aristotle's interpretation.

But what, more precisely, is an actually infinite body? Again Aristotle gives some information, this time when fitting "actual" and "potential" within his own theory of infinity. Such a thing as wood, he comments (206a 18 sq.), is potentially a statue in such a way that there will be an actual

²⁶⁰ 203a18-23 (Ross): τῶν δὲ πεπερασμένα ποιούντων στοιχεῖα οὐθεὶς ἄπειρα ποιεῖ· ὅσοι δ' ἄπειρα ποιοῦσι τὰ στοιχεῖα, καθάπερ Ἀναξαγόρας καὶ Δημόκριτος . . . τῇ ἀφ᾽ ἧ συνεχὲς τὸ ἄπειρον εἶναι φασίν.

²⁶¹ With Ross (p. 547) I take Aristotle to refer to the Atomists chiefly. The Greek for 203b25-26: ἄπειρον δ' ὄντος τοῦ ἔξω, καὶ σῶμα ἄπειρον εἶναι δοκεῖ καὶ κόσμοι. On this text, as well as subsequent ones, see D. J. Furley, "Aristotle and the Atomists," pp. 92-95.

statue. It is not so with the infinite. There will not be an actual infinite (line 20: οὐ . . . ἄπειρον ὃ ἔσται ἐνεργεῖα), since infinity *is* a process (of dividing or adding). Now the crucial lines (206b33 and 207a7):

The infinite turns out to be the contrary of what it is said to be. It is not what has nothing outside it that is infinite but what always has something outside it.²⁶² . . . A quantity is infinite if it is such that we can always take a part outside what has been already taken. On the other hand, what has nothing outside it is complete and whole. For thus we define the whole – that from which nothing is wanting . . . What is true of each particular is true of the whole as such – the whole is that of which nothing is outside. On the other hand that from which something is absent and outside, however small that may be, is not “all.” “Whole” and “complete” are either quite identical or closely akin. Nothing is complete (*teleion*) which has no end (*telos*); and the end is a limit.

What can be gathered from these lines? An actual infinity is, in Aristotle's own thought, an impossibility, since what actually exists is finite (e.g., the length of line left at any stage of bisection, the sum achieved by any process of addition; 206a27). Insofar as finite, it is also complete and whole since it contains everything actual. Nothing (relatively) is left out. But as people usually view it (ὡς λέγουσιν), what has nothing outside (and, thus, is complete and whole) is infinite rather than finite. The reason why nothing is outside some given area is (they would say) the fact that the area has no boundaries or limits and, thus, is so big that it embraces all things. Everything is inside. Such an area would, then, be actually infinite. Now, Leucippus and Democritus may have been among those who spoke of actual infinity as “that which has nothing outside it” (207a1).²⁶³ If they were, then atoms are actually infinite in number because there is literally no end to their number, which is thus large enough to embrace any amount.²⁶⁴ Space and the All would also be actually infinite in extent because their size is literally without termination. Consequently, they are expansive enough to contain infinite numbers of atoms

²⁶² 206b33: συμβαίνει δὲ τοῦναντίον εἶναι ἄπειρον ἢ ὡς λέγουσιν. οὐ γὰρ οὐ μὴδὲν ἔξω, ἀλλ' οὐ αἰεὶ τι ἔξω ἐστί, τοῦτο ἄπειρόν ἐστιν.

²⁶³ Leucippus and Democritus would agree completely with what Aristotle says in 207a8-14. What has nothing outside it is indeed complete and whole, for such is a whole: that from which nothing is wanting, that of which nothing is outside. But their reason differs from that Aristotle gives in 207a14-15. What makes something complete and full is not an end or limit but the exact opposite, rather: the absence of end and limit. Nothing is outside the whole or the All because it has no termination and, thereby, encloses everything whatsoever, even infinite atoms and worlds. Infinity, then, for them is not (as for Aristotle) a process but an entitative state: whatever is *apeiron* is, by that very fact, itself without any terminus.

²⁶⁴ The same would hold analogously for an infinite number of shapes and worlds (whether successive or simultaneous).

and even of *cosmoi*. Absolutely nothing is outside them and they would be prime examples of actual infinities.

When read in this fashion, then, Aristotle discloses that the early Atomists held a doctrine of actual infinity. But is he a reliable guide to their thought? As we already know, some scholars have recommended disbelief in the historical accuracy of Aristotle's statements.²⁶⁵ It even makes some sense to interpret infinity in Leucippus and Democritus as a potential sort. Atoms, their shapes, simultaneous and successive worlds, the void, are infinite inasmuch as no matter how many or extensive they actually are, one need never stop there. One can always think of them as greater. As Aristotle himself says, "They never give out in our thought."²⁶⁶

But it makes even more sense to interpret infinity in early atomism as actual and to accept Aristotle's witness as trustworthy on this point. Certainly, *Physics*, III, ch. 4 sq., reveals that some of his predecessors held body to be actually infinite. Who fits this description better than Leucippus and Democritus? Epicurus, who re-stated atomism a century later, seems undoubtedly to have proposed such a doctrine,²⁶⁷ as this passage discloses. After stating that the totality of reality consists of bodies and void (# 39: τὸ πᾶν ἐστὶ σώματα καὶ κενόν) and discussing why we assent to the existence of each (# 40), he classifies bodies as compounds and their components, which are "irreducible and immutable atoms" (# 41). He then continues:

The sum of things, the All is infinite. For what is finite has an extremity, and the extremity of anything is discerned only by comparison with something else. [Now the sum of things is not discerned by comparison with anything else;] hence, since it has no extremity, it has no limit; and, since it has no limit, it must be unlimited or infinite.²⁶⁸

²⁶⁵ For references see above, "Introduction," note 22; Ch. One, notes 1 and 2.

²⁶⁶ 203b23-24: τὸ ἐν τῇ νοήσει μὴ ὑπολείπειν.

Anaxagoras' conception of infinity would be of this sort. See above, Ch. V, "Anaxagoras" section, Text II (Fragments 1 and 3); Aristotle, *Phys.*, 203a18-23 (supra, p. 170), who however links Anaxagoras with Democritus.

²⁶⁷ See G. Vlastos, "Minimal Parts," p. 131, n. 55: "the actual infinity of the atoms, a cardinal Epicurean doctrine"; *ibid.*, p. 141, n. 94; "the actual infinite," a concept with which Epicurus should be the last to quarrel, since the totality of atoms and worlds in his theory already instantiates the 'actual infinite'." Also see Furley, pp. 128, 154-55; R. Mondolfo, pp. 188-90, 357-59, 497-505, 543-45, 562-68.

²⁶⁸ καὶ τὸ πᾶν ἄπειρόν ἐστι. τὸ γὰρ πεπερασμένον ἄκρον ἔχει... ὥστε οὐκ ἔχον ἄκρον πέρας οὐκ ἔχει· πέρας δὲ οὐκ ἔχον ἄπειρον ἂν εἴη καὶ οὐ πεπερασμένον. Translation for this and subsequent paragraph is after the Loeb; also see George K. Strodach, *The Philosophy of Epicurus* (Chicago: Northwestern University Press, 1963), p. 116. For a similar doctrine, see Lucretius, *De Rerum Natura*, I, lines 951-64.

He then adds a second reason why *to pan* is infinite (# 41-# 42):

Moreover, the sum of things is infinite both because of the multitude of the atoms and the extent of the void. For if the void were infinite and bodies finite, the bodies would not have stayed anywhere but would have been dispersed in their course through the infinite void, not having any supports or counter-checks to send them back on their upward rebound. Again, if the void were finite, the infinity of bodies would not have anywhere to be.²⁶⁹

What points is Epicurus making? The sum-total of reality is infinite because it has no extremity and, therefore, no limit. Also it consists of an infinitude of atoms and of void. Anything real is within it and nothing real is outside. The infinite All is that of which there is nothing outside because its expanse is not curtailed by any limits or extremities.²⁷⁰

Is this not merely a more explicit presentation of the earlier atomism Aristotle sketched in the *Physics*? If so, Leucippus and Democritus also conceived of infinity as actual. That is actually infinite which has nothing outside it because its (literally) limitless extent encloses all reality.²⁷¹

²⁶⁹ The Greek for the first sentence: καὶ τῷ πλήθει τῶν σωμάτων ἄπειρόν ἐστι τὸ πᾶν καὶ τῷ μεγέθει τοῦ κενοῦ.

²⁷⁰ There is, however, one puzzle in Epicurus' assenting to infinity as an attribute of the All, the number of atoms, the extent of the void. One reason why he denied infinite divisibility is, as we mentioned earlier, that it would mean we are capable of "reaching infinity in thought" (*Letter to Herodotus*, #57; Furley, p. 16: εἰς τὸ ἄπειρον . . . ἀφικνεῖσθαι τῇ ἐννοίᾳ), a capacity which we do not have. If we are not able to "reach infinity in thought" through division, why should we have the ability *re* infinity through addition? If we are unable to traverse the infinite number of parts which endless division postulates as present within a single body, how can we traverse the infinite number of atoms within the infinite expanse of void, which constitute the infinite All? Yet without that ability how can we predicate infinity of the All, atoms, shapes and the void? An answer may be that Epicurus' actual infinity should not be conceived as occurring through addition, as a process. Rather, it is an entitative condition of the All, atoms, etc. (see above, n. 263), which moreover is beyond human comprehension.

²⁷¹ Aristotle's rebuttal of Leucippus and Democritus is invalid and irrelevant because it is in terms of his own cosmology only (e.g., void as place without body, natural movement and places, transformation of elements into other elements). The atomistic cosmology was of course quite unAristotelian. See F. Solmsen, *Aristotle's System*, pp. 140-41, 160-73; T. G. Sinnige, pp. 138-70.

CHAPTER VI

IN RETROSPECT

We end our investigation of the Presocratics with the Atomists.²⁷² Leucippus and Democritus were roughly contemporaneous with Socrates (469-406) and, actually, were somewhat younger than the Sophists Protagoras (b. ca. 490) and Gorgias (b. 482). With the Sophists and Socrates attention was turned from "the world of external nature, cosmogony and cosmology with animal and plant life in its physical aspect, and... at this point a change in the climate of thought took place. Man replaced the universe as the focus of interest, moral and political theory was developed while natural philosophy dropped into the background" (G, vol. II, 344).²⁷³ Atomism is not a humanism and, thus, does not belong to the new climate of thought. Rather, it is the philosophy of nature in which Presocratic currents of thought culminate.

What attitudes towards infinity have we discovered in the Presocratic philosophers? Since we have already drawn up conclusions at the end of most chapters above, we can be comparatively brief now. What we say here should be read in the light of those concluding sections and be complemented by them.

The basic methodology we attempted to follow throughout was, as G. B. Kerferd suggested (*CR*, n. s. 17 [1967], 13), to use "the ever-increasing body of modern critical discussions" as a help in interpreting and assessing ancient evidence (both the actual Fragments, preserved as

²⁷² Diogenes of Apollonia, who wrote his philosophical treatises between ca. 440-423 and was a younger contemporary of Anaxagoras (G, vol. II, 348, 362-64), is also a Presocratic. Despite his importance (see *ibid.*, 362, 379), it is unnecessary to treat his theory of infinity separately, since it is so similar to that of other Presocratics. With Anaximenes he held that the *arché* is infinite air; with Leucippus and Democritus that void is infinite and that there are innumerable worlds; with Anaxagoras that there is an infinite variety of scents and colors (G, vol. II, 364-73).

²⁷³ For the nuances of interpretation this traditional view needs, see G, vol. II, 345-54, where Guthrie shows that the philosophers of nature were not totally inattentive to human affairs. For chronology, see *ibid.*, 347-49; *supra*, p. 155.

quotations in subsequent ancient authors, and commentaries or reports on Presocratic doctrines by later writers). We conducted a rather extensive survey of publications between 1947 to 1970 on Anaximander, who initiated the philosophical doctrine of infinity in the West and whose influence on other Presocratics was so strong. With regard to secondary literature on them, we relied to a considerable extent on Kirk-Raven (1963) and on Guthrie (1962 and 1965). But we also made a rather careful check of other studies – those written since the Kirk-Raven and Guthrie books appeared and those published before the mid sixties but needing more attention (for our purposes) than Kirk-Raven and Guthrie paid them.

What information on infinity has our study furnished? The world-views which Anaximander and other Ionians sketched had several features in common. They were cosmogonies. The primal stuff in each was both the material from which the world was made and the agent making it. What set Anaximander apart from them, as well as from other Presocratics, was the fact that his *Urstoff* and *Ursache* was itself *to apeiron*. If it was to be that from which and by which all kinds of things were made, it could not be identified with any one of them or with an amalgam of all of them. It must be some material which by its very nature is indeterminate (*to aoriston*).²⁷⁴ It is, moreover, without beginning or end and, thus, is everlasting. As everlasting source of numerous and divergent beings, it is inexhaustible. In size it is immeasurable: one cannot physically or even mentally traverse its vast expanse. It encompasses all else but nothing contains it. Because of its enormous extent, it has nothing outside it, and, thus, is perhaps the first exemplification of what Aristotle calls “an actual infinite.”²⁷⁵

Such are the meanings *apeiron* seems to have for Anaximander. What is especially noteworthy is that at the very dawn of Western philosophical speculation someone said primal reality *is* the Infinite.²⁷⁶ This affirmation

²⁷⁴ Anaximander does not say this in so many words, but it seems a justified inference. It is, of course, contested by those who view the Anaximandrian primordial substance as a mixture or fusion of various materials and as *apeiron* only with reference to extent, duration and so on. See above, pp. 57-59; also W. Burkert, “Iranisches bei Anaximandros,” *RhM*, 106 (1963), 116-20. Our view of that substance as entitatively *aoriston* moves it closer to Empedocles’ Sphere when completely dominated by Love (there the four elements are fused into a strict unity) than to Anaxagoras’ primal mixture, where *aer* and *aither* are amalgamated but entitatively distinct. See above, Ch. V, n. 230.

²⁷⁵ See above, “Infinity” in “Atomists” section of Ch. V; Ch. II, “Anaximander” and n. 50.

²⁷⁶ Because of this identification Anaximander could be among those whom

is a witness to what matter and the human knower each is. In its extent, variety, duration, continuity and cyclic processes, the material universe points to a basis and cause which differs from and is greater than any of its parts or even their sum-total. *To apeiron* is such a basis and cause and, accordingly, reveals what matter really is. It has aspects which infinitude alone can express. On the other hand, human knowledge is neither a mere inventory of individual material things nor a surface-appraisal of them. Rather, the human knower can transcend their classifications and penetrate their interiors so as to question what they really involve. *To apeiron* is the answer and, thus, the human mind is an openness to infinity, a capacity for the infinite.

The second landmark in the history of infinity is Pythagoreanism. Pythagoras and his early followers admitted into their cosmic theory an *apeiron* which had many characteristics similar to Anaximander's: it was physical, concrete and this-worldly – the breath, air, void which encircled and nourished the world. Unlike Anaximander's, though, it was complemented by a co-principle which was physical too but which was given primacy in entity and function: *peras*. This inhaled and drew in the *apeiron*, thereby limiting and determining it, structuring and transforming it into the numbers which constitute the various natures of material things.

Obviously, the Pythagoreans had begun to realize (however dimly) that one and the same principle could not be both that from which and that by which things are made. The primal substance could not simultaneously be passive and active, moved and movent, indeterminate and determinant. But what is particularly significant is that philosophers had started to have a more adequate understanding of material reality and human cognition. The material universe is not accounted for entirely by what explains and grounds its immense extent, endless variety and duration, continuous and radical mutations – in a word, by *to apeiron*. Material things also involve determinate structure, definite natures and tendencies, forms

Aristotle described as making "the infinite a principle in the sense of a self-subsistent substance [*ousia*] and not as a mere attribute of some other thing" (*Phys.*, 203a4-6, where however he names only Plato and the Pythagoreans).

Although *apeiron* was introduced into Western philosophy by Anaximander, it had been used previously in Greek literature (e.g., Homer, Hesiod), where it had two meanings: "what cannot be passed over or traversed from end to end" and, secondly, "what is immense, enormous." See C. H. Kahn, pp. 231-33. On non-Greek sources which may have ushered Anaximander to the meaning he gave the term, see references above, Ch. I, n. 29. To those should be added: Walter Burkert, "Iranisches bei Anaximandros," 97-134, especially 112-20 (*to apeiron* corresponds to the Persian "anfanglosen Lichter . . . unendliche Licht . . . [which functioned as] der Ursprung der Welt.>").

– in a word, *perata*. Human knowledge, too, does not consist solely in liberation from the here and now, in transcendence of this and that. It is not merely a penetration into what things have in common and undergirds them. Knowledge should be definite also – awareness of various sorts of existents, of determinate structures and proper natures, all of which are on the side of *peras*. Consequently, the human mind is not only open to infinity: it is also anchored in determinateness.

This more adequate insight into material reality and human cognition as each aligned with *apeiron-peras* suffered a set-back at the hands of Parmenides. For him reality²⁷⁷ is limit because Being is precisely a perpetual, necessary, constant and always present concentrate of immutability, unity, completeness, coherence, perfection and definiteness. Since cognition deals solely with Being, knowledge to be genuine and true must be definite and, thus, is permeated with *peras* too. True knowledge is the unwavering contemplation of the pure intelligibility which is Being. Hence, it is intellection solely, intellection freed from the illusions and distractions coming from the senses.

What Parmenides has done appears clear. Taking the Pythagorean couplet *apeiron-peras*, he rejected the *apeiron*-part and all it entailed: the multiplicity of things, the divisibility of matter, the validity of becoming, perfection achieved only through cosmogonical processes, absence preceding presence. The *peras*-part he enlarged into a monism of determinateness, buttressed by an absolute intellectualism and rationalism. The phenomenal world was set aside for the realm of Being. Human knowledge as a combination of sensation-intellection was replaced by pure intellection. The Way of Opinion succumbed to the Way of Truth.

Parmenides' influence is evident not only in his fellow Eleatics, Zeno and Melissus, but also in the pluralists and atomists, who try to salvage the sensible world but without rejecting his basic principles. Anaxagoras' attempt is especially instructive. With Parmenides he denies the existence of void, the reality of change, the origin of multiplicity from unity. Yet he re-affirms infinity. Reality no longer coincides with limit. It is instead

²⁷⁷ The shift from "material reality" to "reality" is not accidental. The material world is not real and, precisely as such, is of no concern to a philosopher. Although Parmenides may possibly have concretized Being as light or a geometrical sphere, he shows little interest in that sort of enterprise. The important thing is to isolate what makes Being be Being. The answer: unity, immutability, presence, coherence, fullness, definiteness – in a word, limit. See "Conclusions" to "Parmenides" section of Ch. IV. On Parmenides' epistemology, see G. Vlastos, "Parmenides' Theory of Knowledge," *TAPA*, 77 (1946), 68-77; H. Fränkel, *Wege und Formen*, pp. 173-79; *idem*, *Dichtung*, pp. 414-16; F. Montero, "El pensar en la doctrina de Parménides," *RFil* (Madrid), 17 (1958), 349-62.

an infinitely great number of varied substances, each of which is infinitely divisible. It entails also a cosmic intelligence infinite in power, knowledge, extent, duration and freedom from internal distinctions. Granted, *peras* is not banished altogether. The substances which are endlessly varied are each of a definite kind and remain so through endless division. The Intelligence is in nature an intelligence. Yet everywhere definiteness is countered by infinity. Everywhere the realm of reality is replaced within the material world. Moreover, sensation is revalidated as a legitimate portion of human cognition.²⁷⁸ An intellect, whether cosmic or human, is marked by openness to *apeiria*, by compatibility and connaturality with it.²⁷⁹

The Atomists' reaction to the Eleatics differs from Anaxagoras' but is equally illuminating. Leucippus and Democritus are inspired by Parmenides when they describe their ultimate particles as single-natured, unalterable and indivisible or "atomic." This affirmation that reality is ultimately indivisible comes (under the influence of Zeno?) as a rebuff to Anaxagoras and as an acknowledgement that reality, as well as knowledge, still has dimensions of definiteness. But in other respects the atomists reinstate *apeiria* even more firmly than did the latter. However identical in kind, however radically immutable and indivisible they may be, atoms are infinite in number and in shape. They move eternally through a void infinite in extent, where they fortuitously and mechanically coalesce to fashion a limitless number of worlds. The result is a sum-total of reality, an All which is infinite and, indeed, actually infinite. *To pan* has nothing

²⁷⁸ Consistently this revalidation should at least have been started and, most likely, it was, as is witnessed by the fact that Anaxagoras' observation of what occurs in nutrition helped suggest his theory of matter (see G, vol. II, 287). But sensation is only one portion of human knowledge. It needs to be completed, deepened, extended and, at times, corrected by intellection. This may be what he intended by Fr. 21: "Owing to their [the senses'] weakness we are unable to discern the truth" (G, vol. II, 319). Moreover, he added: "Phenomena are a sight of the unseen" (Fr. 21a; G, vol. II, 324). What we sense opens up a way to our knowing the nonsensible.

²⁷⁹ This seems true, despite the fact that in his conception of infinity through addition and through division Anaxagoras anticipates Aristotle (see above, Ch. V, n. 266), who equates infinity with potentiality and, thereby, with unintelligibility. The infinite qua infinite is unknowable (*Physics*, 207a25; see above, pp. 120-21). This clash between the two philosophers suggests that Anaxagoras' epistemology differs from Aristotle's. One should recall also that in effect Aristotle abandons his own equation in *Physics*, Book III, Chapter Six. That entire chapter is an enlightening description of what infinity is. How is that description possible unless Aristotle knows what infinity is and entails? Knowledge of *to apeiron* may require that one first cognize what the finite is before he can realize what the non-finite is. But cognition through negation and contrast is still a valid and valuable cognition. (For a different interpretation of infinity in Anaxagoras, see T. G. Sinnige, pp. 129-37, who sees him anticipating Bolzano and Cantor).

outside it because its limitless expanse encompasses whatever is real. Consistently, too, a human knower is open to infinity. How else explain his admission that reality entails, besides *peras*-aspects, an actual infinitude?²⁸⁰

The preceding paragraphs synopsise the story of how *apeiron* fared at the hands of the Presocratic philosophers. What will its fortunes be in the Platonic era? That will be the topic of the next volume.

²⁸⁰ This appears true, in spite of Epicurus' denial of infinite divisibility because the human knower is incapable of "reaching infinity in thought." For a textual reference, an exposition of the difficulty, and one possible solution, see above, Ch. V, n. 270. What one has finally to reply is that man does have knowledge of infinity, however mediate, negative and incomprehensive it may be, as is established by the history of infinity just traced. To some degree man is an openness to infinity, a capacity for *to apeiron*.

On Leucippus' and Democritus' epistemology, see G, vol. II, 451-65; G. Vlastos, "Ethics and Physics in Democritus," *PR*, 54 (1945) 578-92 and 55 (1946), 53-64; *idem.*, "Parmenides' Theory of Knowledge," pp. 76-77; C. C. W. Taylor, "Pleasure, Knowledge and Sensation in Democritus," *Phronesis*, 12 (1967), 6-27; P. J. Bicknell, "The Seat of the Mind in Democritus," *Eranos*, 66 (1968), 10-23.

On Empedocles' doctrine of knowing, see W. J. Verdenius, "Empedocles' Doctrine of Sight," *Studia varia Carolo Guilielmo Volgraff a discipulis oblata* (Amsterdam: A. M. Hakkert, 1948), pp. 155-64; A. A. Long, "Thinking and Sense-Perception in Empedocles," *CQ*, 16 (1966), 256-76; A. Samson, "Aristote et les théories présocratiques sur la connaissance," *LThPh*, 22 (1966) 22-44; J. Bollack, *Empédocle*, I, 256-73; F. Solmsen, "Tissues and the Soul," *PR*, 59 (1950), 437-40.

Also see W. Luther, "Wahrheit, Licht und Erkenntnis in der griechischen Philosophie bis Demokrit," *ABG*, 10 (1966), 1-240; J. Hintikka, "Time, Truth and Knowledge in Ancient Greek Philosophy," *APQ*, 4 (1967), 1-14; B. Snell, *Discovery of the Mind*, esp. pp. vii-xii, 136-52.

APPENDIX

ADDITIONAL STUDIES ON ANAXIMANDER

In these paragraphs we shall briefly discuss studies on Anaximander which became available after our book was completed.

In "L'uno-molti naturalismo degli Ionici. Prima puntata: Da Talete ad Anassimandro," *Sophia*, 36 (1968), 56-97, Mirella Carbonara Naddei investigates the texts of the Ionian philosophers in the light of recent interpretations (e.g., Gomperz, Jaeger, Robin, Franchini) on the occasion of the publication of A. Maddalena's *Ionici. Testimonianze e frammenti* (Firenze: La Nuova Italia, 1963). In place of Maddalena's dualistic interpretation (see pp. 57, 70, 81, 88) and Aristotle's monistic interpretation (see p. 57), Carbonara Naddei opts for a dialectical understanding of the texts (see pp. 57, 58, 66, 67 for mention of Hegel). With reference to Anaximander (pp. 75-97), this option allows *to apeiron* to entail opposing factors simultaneously. The *apeiron* is by nature indeterminate and yet it actually and organically contains hot and cold and other opposites (see pp. 80-81). It is the material cause of things, as well as their active principle through an internal dynamism (p. 79). It surrounds and governs them all, while simultaneously serving as their substrate. Thus it is at once container and contained (pp. 82-84). It is one and yet many: "L'infinito è uno ed è il principio come momento attivo e divino che circonda e governa tutte le cose, e come ciò che tutte le contiene, concretamente ed attualmente sede e vita della molteplicità. Il problema di questo filosofo di Mileto non si può risolvere . . . [except] accettando la posizione di una unita dinamica che è *unità*, ma in quanto *simultaneità* del tutto, e quindi anche *molteplicità*" (p. 83). It dialectically joins simultaneity with succession, passivity with activity, actuality in eternity with potentiality in time (p. 88), immutability with transformation, identity with otherness (p. 90). It harmonizes transcendence with immanence. In the guise of Time it serves both as judge and as the place where injustices occur and expiation takes place: one must "intendere il tempo come una realtà trascendente e immanente

insieme, trascendente, in quanto è giudice che ordina un'espiazione; immanente, in quanto *sede* dell'espiazione stessa e, innanzi tutto, come principio della stessa colpevolezza. Il tempo, potremmo dire con terminologia moderna, heideggeriana, è la *struttura* dell'esistenza: colpa, castigo, riscatto non al di sopra della vita, ma nell'ima profondità della vita stessa" (p. 96).

All this contrasting alignment is possible because of Carbonara Naddei's dialectical conception of Anaximander. But how valid is it? It is, I would say, an anachronism. Anaximander is not Hegel or Heidegger or, even, Heraclitus. Even so, she could have made her point much more briefly and succinctly.

Another study which we became acquainted with only after the manuscript of our book was at the publisher is Rosario Conti's *Cosmogonie orientali e filosofia presocratica* (Roma: Editrice Ciranna, n. d.). This volume was triggered by Conti's distress at Western ignorance of the relationship between oriental culture and the occidental philosophical speculation initiated by the Presocratics (p. 4). Parting company with R  th and Gladisch, who exaggerated the debt of the Presocratics to their oriental predecessors, and also with Zeller, who saw no debt at all, Conti takes the middle road. He is convinced that a scientific or philosophic system is not created but develops from primitive sources, which it transcends however (pp. 4-5). Accordingly, the rational method of the Presocratics is a continuation of the thrust of mythical cosmogonies of the Orient, which nonetheless it enriches and organizes, thus giving the illusion of being an original creation (p. 5: "Il metodo razionale dei Presocratici non far   che continuare lo sforzo delle cosmogonie mitiche dell'Oriente, arricchendole di nuove ricerche e di nuove impostazioni, dando cos   l'illusione di una creazione completamente originale e quasi spontanea").

As one would expect, his book consists of two parts, the first of which (pp. 9-164) recounts cosmogonical myths from India, Iran, Mesopotamia, Egypt, Israel and Greece. The second (pp. 165-470) takes up the Presocratic philosophers from Thales to the Atomists. The chapter on Anaximander is, of course, found there (pp. 193-206) and consists of four sections: "Vita e Opere," "To Apeiron," "Pluralit   di mondi," and "Affinit   mitiche." Let us concentrate briefly upon some points in the last three. The principle from which all things have originated is the Infinite, a single reality which is not any particular element or any substance intermediate between the elements. Rather, it is a primal, ungenerated, eternal principle which sustains and directs all things and which grounds an inexhaustible and perpetual process of generation (p. 196: "l'Infinito (to

apeiron) una realtà che non può essere un elemento particolare, . . . nè una sostanza intermedia tra questo e quell'elemento, ma un principio originario, ingenerato, eterno, che sostiene e dirige tutte le cose, la condizione delle indifettibile perpetuità delle generazioni"). But in what sense is that principle infinite? In size, as qualitatively indeterminate (*ibid.*; "un infinito per grandezza, che è nello stesso tempo qualitativamente indeterminato"), in duration (p. 197: "l'infinità temporale") and as a bottomless resource of existents (*ibid.*: "la riserva inesauribile del divenire"). It is, then, "una sostanza unica, infinita per grandezza e priva di specificazione, dinamica per tendenza" (*ibid.*). Moreover, it is the origin of infinite worlds, which co-exist in it but separately and without knowledge of one another (pp. 200-201). As the primordial abyss and unformed matter from which all things come about, the Infinite is like Chaos in oriental and Grecian cosmogonies and, even, in the Orphic tradition, which pictures Chaos as "eternal, limitless, 'ageless and imperishable,' as neither darkness nor light nor wet nor dry nor hot nor cold but all those factors mingled together in a formless whole" (p. 203). In fact, we need not stop there: factors are also found in Sumerian, Egyptian and Brahmanic cosmogonies which are similar to the Infinite or Chaos (p. 204).

Comments. Conti seems to have strayed from the middle of the exegetical road (see p. 4) by exaggerating the influence of the Orient upon Anaximander. Certainly, *to apeiron* does resemble Chaos and one can easily understand how Hesiod could have influenced the Greek philosopher. But to conclude that the counterparts of the Grecian Chaos in Sumerian, Egyptian and Hindu cosmogonies actually exerted influence on him one needs proof, which is absent because documentation is lacking. The Infinite could be similar to factors in them without having historically originated from them. On most occasions Conti seems to have forgotten his own advice that since Anaximander's own treatise is not extant, one should realize that what subsequent writers credit to him is marked by uncertainty, lacunae, and doubts (p. 196). He might well have imitated D. R. Dicks' scepticism on the validity of the doxographical accounts (see D. R. Dicks, "Thales," *CQ*, 9 [1959], 294-309 and "Solstices, Equinoxes, and the Presocratics," *JHS*, 86 [1966], 26-40), but unfortunately he seems unaware of Dicks' articles. (But see C. H. Kahn, *JHS*, 90 [1970], 99-116).

A third study worthy of mention was actually published before either Naddei's or Conti's but it became available only subsequently: Osvaldo N. Guariglia, "Anaximandro de Mileto Fragmento B 1 (Diels-Kranz)," *Anales de Filología Clásica*, 9 (1964-1965), 23-155. As Guariglia explains in the final section of his article (pp. 151-52), one may attempt to reconstruct a

position in early Greek thought *exteriorly*. Then one sees it as a historical development from myths and as affected by the cultural, social, economic and political circumstances in ancient Ionia. But reconstruction can also be *internal*, whereby one reflects upon the extant textual fragments themselves of the Greek authors. Then one studies the language and modes of expression which they, as well as their predecessors and contemporaries, used so that he can grasp “coherencia y comprensión de la totalidad” (p. 152). This latter method Guariglia himself chose. In an introductory section (pp. 23-30) he discusses the main textual sources of information on Anaximander: Simplicius, Hippolytus, Pseudo-Plutarch, Aetius and Diogenes, all of whom depend upon Theophrastus. In the first part (pp. 31-49) of the main body of the article he investigates all the relevant texts from Aristotle’s *Physics*, *Metaphysics* and *De Generatione*. In the second part (pp. 49-87) he turns to Theophrastus, seeking to distinguish passages in which Theophrastus merely repeats Aristotle from those in which he transmits original information (p. 52). The final part on Anaximander’s Fragment (DK B 1) is itself subdivided into considerations of the context of the Fragment (pp. 92-102), its extent (pp. 102-117) and its interpretation (pp. 118-52).

Guariglia’s informative study is valuable for many reasons, not the least of which are his careful analysis of the texts relating to Anaximander and other Greek authors and his thorough awareness of modern and contemporary interpretations from scholars on every continent. But he spends relatively little time on *to apeiron* itself—a fact which is not surprising in view of his conviction that Anaximander’s own treatise offered little information on the nature of the *apeiron* (p. 43; for a survey of that scanty data see pp. 43-44, 53-56) and even that information was gravely disfigured by Aristotle and Theophrastus (pp. 56, 85-87). He does give considerable attention to topics textually linked with *to apeiron*, though: *to gonimon* (pp. 61-72; his translation of DK 12A 10 is: „Dice que el poder de engendrar desde la eternidad de calor y frío se hizo distinto, coincidiendo con la generación de este mundo”), *apokrisis* (pp. 72-87), and the extent and meaning of the so-called Fragment of Anaximander. Let us dwell on this last for a moment.

In Guariglia’s view not all the words in the two clauses of the Fragment as currently printed in DK B1 are Anaximander’s. In the following reproduction only those are authentic which are underlined (see p. 117):

ἐξ ὧν δὲ ἡ γένεσις ἐστί τοις οὖσι καὶ τὴν φθορὰν εἰς ταῦτα γίνεσθαι
κατὰ τὸ χρόνον· διδόναι γὰρ αὐτὰ δίκην καὶ τίσιν ἀλλήλοις τῆς ἀδικίας
κατὰ τὴν τοῦ χρόνου τάξιν.

Guariglia translates the authentic text in this way: "El nacimiento existe y el perecimiento nace para (todo) lo que es según la necesidad; concede, por tanto, (todo) lo que es mutuamente justicia y compensación, de la injusticia, según el orden del tiempo" (pp. 118 and 133). He considers the second clause to be a consequence of the first but not in an effect-cause relationship. In fact, the two clauses are each expressing the same theme but under different aspects. The first reveals the connection of the two fundamental physical phenomena (coming-to-be and ceasing-to-be) within the structure of beings (p. 144). The second discloses that structure (*ibid.*): all beings are in a critical situation, juxtaposed with one another yet in such a way that each one achieves its own proper character and nature, to which it has a right and which it affirms in opposition to other beings, all of which however are what they are in their own right (p. 142).

BIBLIOGRAPHY

[This bibliography consists of references to studies actually used or mentioned in my chapters or, on occasion, to those especially relevant to the topic of infinity. For other references see *L'année philologique* (Paris: Société d'Édition "Les Belles Lettres") and *Bulletin Signalétique*, "Section 519 [or 19]: Philosophie. Science religieuse" (Paris: Centre de Documentation du Centre National de la Recherche Scientifique); for book reviews see *Répertoire bibliographique de la philosophie*, "Répertoire des comptes rendus" (Louvain: Éditions de l'Institut Supérieur de Philosophie).

For abbreviations used, see list at the beginning of the book].

PRIMARY SOURCES (Texts and Translations):

ARISTOTLE

- Forster, E. S. *Aristotle: On Coming-to-Be and Passing-Away*. ("Loeb Classical Library") Cambridge, Mass.: Harvard University Press, 1955.
Guthrie, W. K. C. *Aristotle: On the Heavens*. ("Loeb Classical Library.") Cambridge, Mass.: Harvard University Press, 1939.
Joachim, H. H. *Aristotle: On Coming-to-be and Passing-Away*. Oxford: Clarendon Press, 1922.
Ross, W. D. *Aristotle: Metaphysics*. Oxford: Clarendon Press, 1924.
—. *Aristotle: Physics*. Oxford: Clarendon Press, 1936.

EPICURUS

- Arrighetti, Graziano. *Epicuro: Opere*. Torino: Einaudi, 1967.
Bailey, C. *Epicurus*. Oxford: Clarendon Press, 1926.
Hicks, R. D. *Diogenes Laertius*. 2 vols. ("Loeb Classical Library.") Cambridge, Mass.: Harvard University Press, 1925.
Long, H. S. *Diogenes Laertius*. 2 vols. Oxford: Clarendon Press, 1964.

HESIOD

- Brown, N. O. *Hesiod's Theogony*. ("Library of Liberal Arts," 36.) New York: Liberal Arts Press, 1953.
Evelyn-White, H. G. *Hesiod: The Homeric Hymns and Homeric*. ("Loeb Classical Library.") Cambridge, Mass.: Harvard University Press, 1954.
Lattimore, Richmond. *The Works and Days, Theogony, The Shield of Herakles*. Ann Arbor: University of Michigan Press, 1959.
West, M. L. *Hesiod: Theogony Edited with Prolegomena and Commentary*. Oxford: Clarendon Press, 1966.

PRESOCRATICS: SEVERAL PHILOSOPHERS

- Battistini, Y. *Trois contemporains: Héraclite, Parménide, Empédocle, trad. nouv. et intégrale avec notices*. ("Coll. Les Essais," 78). Paris: Gallimard, 1955.
- De Vogel, C. J. *Greek Philosophy: A Collection of Texts with Notes and Explanations*. Vol. 1: *Thales to Plato*. 3rd. ed.; Leiden: Brill, 1963.
- Diels, H. *Doxography Graeci*. 1st ed.; Berlin: Walter de Gruyter and Co., 1879; reprint: 1958.
- Diels, H. and Kranz, W. *Die Fragmente der Vorsokratiker*. 3 vols. 6th ed.; Zürich: Weidmann, 1951; reprinted: 1966.
- Freeman, K. *Ancilla to the Presocratic Philosophers*. Cambridge, Mass.: Harvard University Press, 1948.
- Kirk, G. S. and Raven, J. E. *The Presocratic Philosophers: A Critical History with a Selection of Texts*. 4th printing; Cambridge: University Press, 1963.
- Maddalena, A. *Ionici. Testimonianze e frammenti, introd., testo, trad. e comm.* ("Bibl. di Studi Sup.," 42.) Firenze: La Nuova Italia, 1963.
- Mondolfo, Rudolfo. *Il pensiero antico: Storia della filosofia Greco-Romana esposta con testi scelti dalle fonti*. 3rd ed.; Firenze: La Nuova Italia, 1967. (For texts of the Presocratics, see Libro I: "Il predominio del problema cosmologico," pp. 29-125; for bibliography see pp. 607-612 and 626-34.)
- Nahm, M. C. *Selections from Early Greek Philosophy*. 3rd ed.; New York: Appleton-Century-Crofts, 1947.
- Ritter, H. et L. Preller. *Historia Philosophiae Graecae. Testimonia Auctorum*. 9th ed.; Gotha: Perthes, 1913.
- Vuia, O. *Remontée aux sources de la pensée occidentale (Anaxagore, Héraclite, Parménide): Nouv. présentation des fragm. en grec et en franc. et leurs doxographies*. Paris: Centre Roumain de Recherches, 1961.
- Wheelwright, Philip. *The Presocratics*. New York: The Odyssey Press, 1966.
- Zafiropulo, J. *L'école éléate. Parménide, Zénon, Mélissos*. ("Coll. d'Études Anciennes.") Paris: Les Belles Lettres, 1950.

PRESOCRATICS: INDIVIDUAL PHILOSOPHERS

Anaxagoras

- Lanza, Diego. *Anassagora. Testimonianze e Frammenti*. ("Biblioteca di Studi Superiori," 52) Firenze: La Nuova Italia, 1966.

Empedocles

- Bignone, E. *Empedocle: Studio crit., trad. e comm. delle testimonianze e dei frammenti*. Torino. 1916; Roma: L'Erma, 1963.
- Bollack, Jean. *Empédocle. II: Les Origines: Édition et traduction des fragments et des témoignages*. Paris: Éditions de Minuit, 1969.
- Brun, J. *Empédocle, ou la philosophie de l'amour et de la haine: Présent., choix de textes, trad. bibliogr.* ("Coll. Philosophes de tous les temps," 27). Paris: Seghers, 1966.
- Kranz, W. *Empedokles. Antike Gestalt und romantische Neuschöpfung*. Zürich: Artemis-Verl., 1949.
- Zafiropulo, J. *Empédocle d'Agrigente [avec texte et traduction des fragments]*. ("Coll. d'Études anciennes.") Paris: Les Belles Lettres, 1953.
- . *Katharmoi d'Empédocle [title in Greek]: Ed., trad. et annoté*. Paris: Tallone, 1954.

Heraclitus

- Axelos, K. *Les fragments*. Paris: Éd. Estienne, 1958.
- Brun, J. *Héraclite ou le philosophe de l'éternel retour: Prés., choix de textes, trad. et bibliogr.* ("Coll. Philosophes de tous les temps," 17.) Paris: Seghers, 1965.
- Burckhardt, G. *Heraklit, Urworte der Philosophie (Fragmente): Griech. und ins Dt. übertr.* ("Insel-Bücherei," 49.) Wiesbaden: Insel-Verl., 1951.
- Bywater, I. *Heracliti Ephesii Reliquiae*. Oxford: University Press, 1877.
- Jeannière, A. *La pensée d'Héraclite d'Éphèse et la vision présocratique du monde, avec la traduction intégrale des fragments.* ("Coll. Philosophie de l'esprit.") Paris: Aubier, 1959.
- Kirk, G. S. *The Cosmic Fragments of Heraclitus: A Critical Study with Introd., Text and Transl.* Cambridge: University Press, 1954.
- Mazzantini, C. *Eraclito. I frammenti e le testimonianze, introd. e comm.* Torino: Chiantore, 1945.
- Quiring, H. *Heraklit. Worte tönen durch Jahrtausende*. Berlin: W. de Gruyter, 1959.
- Wheelwright, Philip. *Heraclitus*. Princeton, New Jersey: University Press, 1959; [paperback] New York: Atheneum Publishers, 1964.
- Winterhalder, L. *Das Wort Heraklits*. Zürich: Rentsch, 1962.

Parmenides

- Beaufret, J. *Le poème de Parménide.* ("Coll. Épiméthée, Essais philosophiques.") Paris: Presses Universitaires, 1955.
- Montero Moliner, F. *Parmenides*. Madrid: Grados, 1960.
- Tarán, L. *Parmenides: A Text with Transl., Comm. and Critical Essays*. Princeton, New Jersey: University Press, 1965.
- Untersteiner, M. *Parmenide. Testimonianze e frammenti, introd. trad. e comm.* ("Bibl. di Studi Sup." 38.) Firenze: La Nuova Italia, 1958.

Pythagoreans

- Maddalena, A. *I Pitagorici.* ("Filosofi antichi e mediev.") Bari: Laterza, 1954.
- Saint-Michel, L. *Les Vers d'or de Pythagore, texte et trad. avec notes.* ("Coll. Les Valeurs Essentielles.") Bourges: Typ. Boin, 1950.
- Thesleff, H. *The Pythagorean Texts of the Hellenistic Period.* ("Acta Acad. Aboensis," XXX, 1). Abo: Akademi, 1965.
- Timpanaro Cardini, M. *Pitagorici: Testimonianze e frammenti.* ("Bibl. di Studi Sup.," 28). Firenze: La Nuova Italia, 1958, 1962 e 1964. 3 vols.

Zeno

- Lee, H. D. P. *Zeno of Elea*. Cambridge: University Press, 1936.
- Quiles, I. and E. I. Granero. "Los Eleatos, Zenon y Meliso [texts and translation]," *Ciencia y Fe*, 6 (1950), 101-110.
- Untersteiner, M. *Zenone. Testimonianze e frammenti. Introduzione, traduzione e commento.* ("Bibl. di Studi Sup.," 46) Firenze: La Nuova Italia, 1963.

Xenophanes

- Untersteiner, M. *Senofane. Testimonianze e frammenti: Introduzione, traduzione e commentario.* ("Bibl. di Studi Sup.," 33.) Firenze: La Nuova Italia, 1956.

SIMPLICIUS

- Heiberg, J. L. (ed.). *Simplicii in Aristotelis Quattuor Libros De Caelo Commentaria. Commentaria in Aristotelem Graeca*, Vol. VII. Berlin: G. Reimer, 1894.
- Diels, Hermannus (ed.). *Simplicii in Aristotelis Physicorum Libros Quattuor Priores Commentaria. Commentaria in Aristotelem Graeca*, Vol. IX. Berlin: G. Reimer, 1882.
- . *Simplicii in Aristotelis Physicorum Libros Posteriores Commentaria. Commentaria in Aristotelem Graeca*, Vol. X. Berlin: G. Reimer, 1895.

THOMAS AQUINAS

- Roland-Gosselin, M. D. *Le "De Ente et Essentia" de S. Thomas d'Aquin*. ("Bibliothèque Thomiste," VIII.) Paris: J. Vrin, 1926.

SECONDARY LITERATURE

- Aalders, G. J. D. "The Political Faith of Democritus," *Mnemosyne*, 3 (1950), 302-313.
- Adhikary, R. C. "Mythology, Metaphysics and Mysticism, Hellenic and Hindu," *Science*, 50 (1956), 156-63.
- Afnan, R. M. *Zoroaster's Influence on Greek Thought*. New York: Philosophical Library, 1965.
- Agoglia, R. M. "Indeterminación óptica y equilibrio ontológico en Anaximandro," *Revista de filosofía de la Universidad Nacional de la Plata*, 18 (1967), 7-19.
- Alfieri, V. E. *Atomos Idea: L'origine del concetto dell'atomo nel pensiero greco*. Firenze: Le Mounier, 1953.
- Allen, R. E. "Interpretation of Plato's *Parmenides*, Zeno's Paradox and Theory of Forms," *JHP*, 2 (1964), 143-55.
- Antweiler, A. *Unendlich – Eine Untersuchung zum metaphysischen Wesen Gottes auf Grund der Mathematik, Philosophie, Theologie*. Freiburg im Breisgau: B. Herder Co., 1934.
- Armstrong, A. H. *An Introduction to Ancient Philosophy*. London: Methuen and Co., Ltd., [2nd ed.] 1949.
- Axelos, K. *Héraclite et la philosophie. La première saisie de l'être en devenir de la totalité*. Paris: Éd. de Minuit, 1962.
- Bacchin, G. R. "Intero metafisico e problematicità pura," *RFNS*, 57 (1965), 305-21.
- Bădăraș, D. "Le nombre chez les premiers Pythagoriciens," *Analele Univ. dei Bucaresti*, Ser. Acta. Log. V. 2 (1962), 87-101.
- Bailey, Cyril. *The Greek Atomists and Epicurus*. Oxford: Clarendon Press, 1928.
- Ballauff, T. "Interpretationen zu Thales und Anaximanders Philosophie," *TPh*, 15 (1953), 18-70.
- Barnes, Hazel E. "Unity in the Thought of Empedocles," *CJ*, 63 (1967), 18-23.
- Basson, A. H. "The Way of Truth," *PAS*, 61 (1960-61), 73-86.
- Bausola, A. "Sul problema del divenire," *RFNS*, 57 (1965), 271-7.
- Beare, J. I. *Greek Theories of Elementary Cognition From Alcmaeon to Aristotle*. Oxford: Clarendon Press, 1906.
- Becker, O. "Drei Bemerkungen zum Lehrgedicht des Parmenides," *Kant-Studien*, 55 (1964), 255-59.
- Bergson, Henri. *Creative Mind*, transl. M. L. Andison. New York: Philosophical Library, 1946.
- . *Time and Free Will*, transl. F. L. Pogson, New York: Macmillan, 1910.
- Bicknell, P. J. "To apeiron, apeiros aēr and to periechon," *Acta Classica*, 9 (1966), 27-48.

- . "Parmenides' Refutation of Motion and an Implication," *Phronesis*, 12 (1967), 1-5.
- . "Aetius II, 14, 3 and Asclepiades of Myrica," *Apeiron*, 2 (1967), 14-15.
- . "The Seat of the Mind in Democritus," *Eranos*, 66 (1968), 10-23.
- . "Parmenides, Fragment 10," *Hermes*, 96 (1968), 629-31.
- Biès, J. "Empédocle et l'orient," *BAGB*, 27 (1968), 365-403.
- Bindel, E. *Pythagoras. Leben und Lehre in Wirklichkeit und Legende*. Stuttgart: Freies Geistesleben, 1962.
- Black, Max. *The Nature of Mathematics: A Critical Survey*. Paterson, New Jersey: Littlefield, Adams Co., 1959. (On Zeno's paradoxes, pp. 89-97).
- Boas, George. *Rationalism in Greek Philosophy*. Baltimore: Johns Hopkins Press, 1961.
- Boeder, H. "Parmenides und der Verfall des kosmologischen Wissens," *PhJ*, 74 (1966), 30-77.
- Bollack, J. "Die Metaphysik des Empedocles als Entfaltung des Seins," *Philologus*, 101 (1957), 30-54.
- . *Empédocle. I: Introduction à l'ancienne physique. II: Les Origines: Edition et traduction des fragments et des témoignages. III: Les Origines: Commentaire I et 2*. Paris: Éditions de Minuit, 1965 et 1969.
- . Review of Deichgraeber's *Parmenides' Auffahrt zur Göttin in Gnomon*, 38 (1966), 321-29.
- . Review of Nélod's *Empédocle d'Agrigente in Gnomon*, 38 (1966), 725-27.
- . Review of Untersteiner's *Parmenide. Testimonianze e frammenti in Gnomon*, 40 (1968), 533-40.
- . "Les zones de la cosmogonie d'Empédocle," *Hermes*, 96 (1968), 239-40.
- Bonetti, A. "La concezione dialettica della realtà in Eraclito," *RFNS*, 52 (1960), 319-35.
- Bontadini, G. "Sōzein ta phainomena" [title in Greek], *RFNS*, 56 (1964), 439-68.
- Booth, N. B. "Were Zeno's Arguments Directed Against the Pythagoreans?" *Phronesis*, 2 (1957), 90-103.
- . "Were Zeno's Arguments a Reply to Attacks upon Parmenides?" *ibid.*, 2 (1957), 1-9.
- . "Zeno's Paradoxes," *JHS*, 77 (1957), 187-201.
- . "Did Melissus Believe in Incorporeal Being?" *AJP*, 79 (1958), 61-65.
- Boussoulas, N. "Essai sur la structure du mélange dans la pensée présocratique: le nous et le mélange dans le système d'Anaxagore," *BAGB*, 15 (1956), 18-43.
- . "Les Pythagoriciennes. Essai sur la structure du mélange dans la pensée présocratique," *RMM*, 64 (1959), 385-95.
- . "La structure du mélange dans la pensée antique," *BAGB*, 19 (1960), 481-98.
- . "La structure du mélange dans la pensée de Parménide," *RMM*, 69 (1964), 1-12.
- Bowra, C. M. "The Proem of Parmenides," *CP*, 32 (1937), 97-112.
- Brock, E. "Die Philosophie der Pythagoräer," *Studia Philosophica* (Swiss), 23 (1963), 29-50.
- Bröcker, W. *Die Geschichte der Philosophie vor Sokrates*. Frankfurt: Klostermann, 1965.
- Brumbaugh, R. S. *The Philosophers of Greece*. New York: Crowell, 1964.
- . Review of Tarán's *Parmenides in IPQ*, 6 (1966), 496-99.
- Burch, G. B. "Anaximander, the First Metaphysician," *RM*, 3 (1949), 137-60.
- Burkert, Walter. "Plato oder Pythagoras?" *Hermes*, 88 (1960), 159-77.
- . *Weisheit und Wissenschaft: Studien zu Pythagoras, Philolaos und Platon*. Nürnberg: Verlag Hans Carl, 1962.
- . "Iranisches bei Anaximandros," *RhM*, 106 (1963), 97-134.

- . "Orpheus und die Vorsokratiker. Bemerkungen zum Derveni-Papyrus und zur pythagoreischen Zahlenlehre," *Antike und Abendland*, 14 (1968), 93-114.
- . "Das Proömium des Parmenides und die Katabasis des Pythagoras," *Phronesis*, 14 (1969), 1-30.
- Bury, R. G. *The Philebus of Plato*. Cambridge: University Press, 1897.
- Cajori, Florian. "The History of Zeno's Arguments on Motion," *American Mathematical Monthly*, 22 (1915), 1-6, 39-47, 77-82, 109-115, 143-49, 179-86, 215-20, 253-58, 292-97.
- Calogero, G. *Studi sul Eleatismo*. Roma: Tipografia del Senato, 1932.
- . "L'eleatismo di Empedocle," *Studi in onore di L. Castiglioni* (Firenze: Sansone, 1960), I, 127-67.
- . Review of Kirk-Raven's *Presocratic Philosophers* in *Gnomon*, 34 (1962), 321-35.
- . "Paradoxes logiques et réalité dialogique," *Bulletin de la Société française de Philosophie*, 60 (1966), 37-38.
- Cantor, Georg. *Contributions to the Founding of the Theory of Transfinite Numbers*, transl. P. E. B. Jourdain. Chicago: Open Court Publishing Co., 1915. (German version appeared in *Mathematische Annalen*, 46 [1895], 481-512 and 49 [1897], 207-248).
- Capelle, W. "Farbenbezeichnungen bei Theophrast," *RhM*, 101 (1958), 1-41.
- Capparelli, V. *La Sapienza di Pitagorica*, 2 vols. Milano: Cedam, 1941.
- Cappelletti, A. J. "Sobre el concepto del nous de Anaxagoras," *Universidad*, 42 (1959), 53-68.
- . "Leucipo y los origines del atomismo griego," *Humanitas*, 14 (1967), 11-30.
- Carbonara Naddei, M. "L'uno-molti nel naturalismo degli Ionici. Prima puntata: da Talete ad Anassimandro. Seconda puntata: Anassimene," *Sophia*, 36 (1968), 56-97 and 224-40.
- . "Scienza e metafisica nei primi filosofi greci," *Logos*, 1 (1969), 114-34.
- Carena, C. "A proposito dell'*apeiron* di Anassimandro," *Revista Rosminiana di Filosofia e di Cultura*, 55 (1961), 39-40.
- . "La cosmologia di Talete e la coppa solare dei poeti ionici," *ibid.*, 56 (1962), 22-32.
- Catania, Francis J. "Divine Infinity According to Albert the Great's Commentary on the *Sentences*." Unpublished Ph. D. Dissertation, Department of Philosophy, St. Louis University, 1959.
- Cherniss, H. *Aristotle's Criticism of Presocratic Philosophy*. Baltimore: Johns Hopkins Press, 1935; New York: Octagon Books, Inc., 1964.
- . Review of Raven's *Pythagoreans and Eleatics* in *PR*, 59 (1950), 375-77.
- . "Characteristics and Effects of Presocratic Philosophy," *JHI*, 12 (1951), 319-45.
- Chihara, C. S. "On the Possibility of Completing an Infinite Process," *PR*, 74 (1965), 74-87.
- Chrosara, A. A. "Analisi di un sofisma quantitativo: L'Achilles ossia l'inutilità dell'inseguimento secondo Zenone di Elea," *Angelicum*, 44 (1967), 315-38.
- Classen, C. Joachim. "Anaximander," *Hermes*, 90 (1962), 159-72.
- . "Licht und Dunkel in der frühgriechischen Philosophie," *Studium Generale*, 18 (1965), 97-116.
- . Review of W. Luther's *Wahrheit, Licht und Erkenntnis* in *Gnomon*, 39 (1967), 444-49. Also: "Anaximandros," *RE*, 12 (1970), cols. 30-69.
- Cleve, Felix M. *The Philosophy of Anaxagoras*. New York: King's Crown Press, 1949.
- . Review of Quiring's *Heraklit* and Wheelwright's *Heraclitus* in *NS*, 35 (1961), 116-20.
- . "Understanding the Pre-Socratics: Philological or Philosophical Reconstruction?"

- IPQ*, 3 (1963), 445-64.
- . *The Giants of Pre-Sophistic Greek Philosophy: An Attempt to Reconstruct Their Thoughts*. The Hague: Martinus Nijhoff, 1965. 2 vols.
- Chappell, V. C. "Time and Zeno's Arrow," *JP*, 59 (1962), 192-213.
- Cohn, Jonas. *Geschichte des Unendlichkeitsproblems im abendländischen bis Kant*. Leipzig: H. R. Engelmann, 1896; Hildesheim: Georg Olms, 1960.
- Conti, R. *Cosmogonie orientale e filosofia presocratica*. Roma: Ciranna, 1967.
- Corbato, C. "Studi Senofanei," *Annali Triestini*, 22 (1952), 179-244.
- . "Postilla Senofanea 1952-1962," *RSF*, 18 (1963), 229-47.
- Cornford, F. M. "Anaxagoras' Theory of Matter," *CQ*, 24 (1930), 1-31 and 83-95.
- . *Principium Sapientiae: The Origins of Greek Philosophical Thought*. Cambridge: University Press, 1952.
- . *Plato and Parmenides. Parmenides' "Way of Truth" and Plato's "Parmenides" Translated with an Introduction and a Running Commentary*. New York: Liberal Arts Press, 1957.
- Corte, Marcel de. "Mythe et philosophie chez Anaximandre." *LThPh*, 14 (1958), 9-29.
- . "La vision philosophique d'Héraclite," *LThPh*, 16 (1960), 189-236.
- . "Anaximène," *LThPh*, 18 (1962), 35-58.
- Coxon, A. H. "The Manuscript Tradition of Simplicius' Commentary on Aristotle's *Physics*, I-IV," *CQ*, n. s. 18 (1968), 70-75.
- Crombie, I. M. *An Examination of Plato's Doctrines*. Vol. Two: *Plato on Knowledge and Reality*. London: Routledge & Kegan Paul, 1963.
- Daly, S. J., John Vincent. "The Human Soul According to Gerard of Abbeville." Unpublished Master's Thesis, Department of Philosophy, St. Louis University, 1960.
- De Boer, Jesse. "Continuity and Infinity in Bergson and Russell," *Return to Reason*. Ed. John Wild. Chicago: Henry Regnery, 1953. Pp. 92-124.
- Dedekind, R. *Essays on the Theory of Numbers*, transl. W. W. Beman. La Salle, Illinois: Open Court Publishing Co., 1948.
- Deichgräber, K. "Anaximander von Milet," *Hermes*, 75 (1940) 10-19.
- . *Parmenides' Auffahrt zur Göttin des Rechts. Untersuchungen zum Prooimion seines Lehrgedichts*. Wiesbaden: Steiner, 1959.
- Deku, H. "Infinitum Prius Finito," *PhJ*, 62 (1953), 267-84.
- De Lucca, J. "Three Interpretations [Bergson, Santayana, Russell] of Presocratic Philosophers," *CJ*, (1965), 158-63.
- Des Places, E. "Bulletin critique: Philosophie religieuse des Grecs," *RecSR*, 50 (1962), 599-632.
- . "Bulletin de la philosophie religieuse des Grecs," *RecSR*, 56 (1968), 602-27.
- . "Deux études sur la prière en Grèce," *REG*, 81 (1968), 384-85.
- De Santillana, Giorgio. *Origins of Scientific Thought*. Chicago: University of Chicago Press, 1961.
- De Vogel, C. J. *Pythagoras and Early Pythagoreanism. An Interpretation of Neglected Evidence on the Philosopher Pythagoras*. Assen: Van Gorcum and Company, 1966.
- . Review of Philip's *Pythagoras* in *JHS*, 89 (1969), 163-65.
- Detienne, M. *La notion de daimôn dans le pythagorisme ancien*. Paris: Société d'Édition "Les Belles Lettres," 1963.
- . "Les origines religieuses de la notion d'intellect. Hermotime et Anaxagore," *RPhilos*, 89 (1964), 167-78.
- . *Les maîtres de vérité dans la Grèce archaïque*. Paris: Maspero, 1967.
- Dicks, D. R. "Thales," *CQ*, 9 (1959), 294-309.
- . "Solstices, Equinoxes, and the Presocratics," *JHS*, 86 (1966), 26-40.

- Diels, H. "Anaximandros von Milet," *Neue Jahrbücher für das klassische Altertum*, 51 (1923), 65-75.
- Dirlmeier, F. "Der Satz des Anaximandros von Milet," *RhM*, 87 (1938), 376-82.
- Dubrule, Diane E. "Divine Infinity in the Writings of Henry of Ghent." Unpublished Ph.D. Dissertation, University of Toronto, 1967.
- Ducci, E. "Il *to eon* parmenideo nella interpretazione di Simplicio," *Angelicum*, 40 (1963), 173-94 and 313-27.
- Duggan, S.J., Thomas Arthur. "Participation in the *Enneads* of Plotinus." Unpublished Master's Thesis, Department of Philosophy, St. Louis University, 1963.
- Eisler, R. "Unendlich," *Wörterbuch der philosophischen Begriffe*, IV, iv (Berlin: 1927-1930), 306-320.
- Emmett, E. R. "Infinity," *Mind*, 66 (1957), 241-49.
- Esnoul, A-M. and others. *La naissance du monde*. Paris: Seuil, 1959.
- Ferguson, J. "Two Notes on the Preplatonic [Empedocles DK 31 A 30; Anaxagoras DK 59 B 11]," *Phronesis*, 9 (1964), 98-106.
- Fink, E. *Zur ontologischen Frühgeschichte von Raum-Zeit-Bewegung*. The Hague: Martinus Nijhoff, 1957.
- François, G. *Le Polythéisme et l'emploi au singulier des mots theos daimōn dans la littérature grecque d'Homère à Platon*. Paris: Société d'Édition "Les Belles Lettres," 1957.
- Frank, Erich. *Platon und die sogenannten Pythagoreer*. Halle: Max Niemeyer, 1923.
- Fränkel, Hermann. "Zeno of Elea's Attacks on Plurality," *AJP*, 63 (1942), 1-25 and 193-206.
- . *Wege und Formen frühgriechischen Denkens* (Literarische und philosophiegeschichtliche Studien). Herausgegeben von Franz Tietze. 2nd ed.; München: C. H. Beck, 1960.
- . *Dichtung und Philosophie des frühen Griechentums*. (Eine Geschichte der griechischen Epik, Lyrik und Prosa bis zur Mitte des fünften Jahrhunderts). 2nd ed.; München: C. H. Beck, 1962.
- Frey, G. "Eine Grundfigur griechischen Denkens," *ZPhF*, 18 (1964), 224-39.
- Fritz, Kurt von. *Pythagorean Politics in South Italy: An Analysis of the Sources*. New York: Columbia University Press, 1940.
- . "Nous, noein and Their Derivatives in Homer," *CP*, 38 (1943), 79-93.
- . "Nous, Noein and Their Derivatives in Pre-Socratic Philosophy," *ibid.*, 40 (1945), 223-42 and 41 (1946), 12-34.
- . "Discovery of Incommensurability by Hippasus of Metapontum," *Annals of Mathematics*, 46 (1945), 242-64.
- . "Pythagoras," *RE*, 24 (1963), cols. 171-209.
- . "Der nous des Anaxagoras," *ABG*, 9 (1964), 87-102.
- . Review of Philip's *Pythagoras* in *Gnomon*, 40 (1968), 6-13.
- . "Das apeiron bei Aristoteles," *Naturphilosophie bei Aristoteles und Theophrast* (Verhandlungen des 4. Symposium Aristotelicum). Heidelberg: Lothar Stiehm, 1969. Pp. 65-84.
- Fritz, Kurt von and others. *Hésiode et son influence*. ("Entretiens sur l'antiquité clas.," 7.) Genève-Vandoeuvres: Fond. Hardt, 1962.
- Furley, David J. *Two Studies in Greek Atomists: Indivisible Magnitudes; Aristotle and Epicurus on Voluntary Action*. Princeton, New Jersey: Princeton University Press, 1967.
- . "Melissus," *EP*, V, 264-65.
- . "Aristotle and the Atomists on Infinity," *Naturphilosophie bei Aristoteles und Theophrast* (Verhandlungen des 4. Symposium Aristotelicum). Heidelberg: Lothar Stiehm, 1969). Pp. 85-96.

- Furth, Montgomery. "Elements of Eleatic Ontology," *JHP*, 6 (1968), 111-32.
- Gadamer, H. G. *Um die Begriffswelt der Vorsokratiker*, Darmstadt: Wissenschaftliche Buchgesellschaft, 1968.
- Garcia-Junceda, J. A. "El pitagorismo antiguo. Valores científicos de una actitud mítica," *Estudios filosoficos*, 17 (1968), 419-69.
- Gelpi, S. J., Donald Louis. "Logos as a Cosmological Principle in Plotinus." Unpublished Master's Thesis, Department of Philosophy, Saint Louis University, 1958.
- Gershenson, Daniel E. and Greenberg, Daniel A. *Anaxagoras and the Birth of Physics*. New York: Blaisdell Publishing Company, 1964.
- Giacon, C. "Ritornare a Parmenide?" *RFNS*, 56 (1964), 469-85.
- Gigon, O. *Untersuchungen zu Heraklit*. Leipzig: Dieterich, 1935.
- . *Der Ursprung der griechischen Philosophie*. Basel: Benno Schwabe and Co., 1945.
- . "Zu Anaxagoras," *Philologus*, 91 (1936-1937), 1-41.
- Gladigow, B. "Pneumatik und Kosmologie," *Philologus*, 111 (1967), 1-20.
- Gomperz, Theodor. *Greek Thinkers*, transl. L. Magnus and G. G. Berry. London: John Murray, 1920. 4 vols.
- Gottschalk, H. B. "Anaximander's Apeiron," *Phronesis*, 10 (1965), 37-53.
- Grey, Denis. Review of Loenen's *Parmenides* in *JHS*, 81 (1961), 184-86.
- Grünbaum, Adolf. "Modern Science and Refutation of the Paradoxes of Zeno," *Scientific Monthly*, 81 (1955), 234-37.
- . *Philosophical Problems of Space and Time*. New York: Alfred A. Knopf, 1963.
- . *Modern Science and Zeno's Paradoxes*. Middletown, Conn.: Wesleyan University Press, 1967.
- . "Can an Infinitude of Operations be Performed in a Finite Time," *BJPS*, 20 (1969), 203-18.
- Guariglia, O. N. "Anaximandro de Mileto. Fragmento B1 (Diels-Kranz)," *Anales de Filologia Clasica* (Buenos Aires), 9 (1964-65), 23-155.
- Guazzoni Foà, V. "Dall'apeiron d'Anassimandro all'ateleston di Parmenide," *GM*, 15 (1960), 465-74.
- . "Significato e importanza di alcuni termini della cosmologia greca," *GM*, 18 (1963), 89-101.
- . "Un ripensamento sulla sphaera di Parmenide," *GM*, 21 (1966), 344-54.
- Guthrie, W. K. C. *The Greeks and Their Gods*. London: Methuen and Co., 1950.
- . *Orpheus and Greek Religion*. London: Methuen and Co., 1952.
- . "The Presocratic World-Picture," *HSCP*, 45 (1952), 87-104.
- . *In the Beginning: Some Greek Views on the Origins of Life and the Early State of Man*. London: Methuen, 1957.
- . "Aristotle as a Historian of Philosophy," *JHS*, 77 (1957), 35-41.
- . Review of Burkert's *Weisheit und Wissenschaft in Mind*, 75 (1966), 293-95.
- . *A History of Greek Philosophy*, Vol. One: *The Earlier Presocratics and the Pythagoreans*. Vol. Two: *The Presocratic Tradition from Parmenides to Democritus*. Cambridge: University Press, 1962 and 1965.
- Guyot, H. "Sur apeiron d'Anaximandre," *RPhilos*, 5 (1904), 708-715.
- . *L'infinité divine depuis Philon le Juif jusqu'à Plotin*. Paris: Félix Alcan, 1906.
- Haase, R. "Harmonikale Symbolik und neue Pythagorasforschung," *Symbolon*, 5 (1966), 76-91.
- Hack, R. K. Review of Mondolfo's *L'infinito nel pensiero dell'antichità classica* in *AJP*, 33 (1938), 104-109.
- Hamlyn, D. W. Review of Furley's *Two Studies in Greek Atomists* in *PQ*, 18 (1968), 166.

- Harrison, A. "Zeno's Paper Chase," *Mind*, 76 (1967), 568-75.
- Havelock, Eric A. "Parmenides and Odysseus," *HSCP*, 63 (1958), 133-43.
- Heath, Sir Thomas, *A History of Greek Mathematics*. Vol. One: *From Thales to Euclid*. Vol. Two: *From Aristarchus to Diophantus*. Oxford: Clarendon Press, 1921.
- Heidegger, Martin. "Der Spruch des Anaximander," *Holzwege* (3rd ed.; Frankfurt am Main: Klostermann, 1957), pp. 296-343.
- Heidel, W. A. "The *dinē* in Anaximenes and Anaximander," *CP*, 1 (1906), 279-82.
- . "On Anaximander," *CP*, 7 (1912), 212-34.
- . "*Peras* and *Apeiron* in the Pythagorean Philosophy," *AGPh*, 14 (1932), 384-99.
- . "The Pythagoreans and Greek Mathematics," *AJP*, 61 (1940) 1-33.
- Heisenberg, Werner. *The Physicist's Conception of Nature*, transl. Arnold J. Pomerans. New York: Harcourt, Brace and Company, 1958.
- Helm, B. "Social Roots of the Heraclitean Metaphysics," *JHI*, 25 (1964), 565-71.
- Herrero, J. "Materia e idea en el ente de Parmenides," *RFil*, 15 (1956), 261-72.
- Herzog, K. "Metaphysische Probleme in der Astronomie des Xenophanes," *Kant-Studien*, 58 (1967), 399-432.
- Hill, E. R. Review of Mondolfo's *L'infinito nel pensiero dell'antichità classica* in *JHS*, 79 (1959), 175-76.
- Hölscher, U. "Anaximander und die Anfänge der Philosophie," *Hermes*, 81 (1953), 257-77 and 385-418.
- . "Weltzeiten und Lebenszyklen. Eine Nachprüfung der Empedokles-Doxographie," *ibid.*, 94 (1965), 7-33.
- . *Anfängliches Fragen*. Göttingen: Vandenhoeck und Ruprecht, 1968.
- . *Parmenides: Vom Wesen des Seienden*. Frankfurt a. M.: Suhrkamp, 1969.
- Hueffmeier, F. "Teleologische Weltbetrachtung bei Diogenes von Apollonia," *Philologus*, 107 (1963), 131-38.
- Huntington, E. V. *The Continuum and Other Types of Serial Order*. Cambridge, Mass.: Harvard University Press, 1929.
- Huit, C. "Les notions d'infini et de parfait," *Revue de philosophie*, 5 (1904), 738-57 and 6 (1905), 44-66.
- Ilting, Karl-Heinz. "Zur Philosophie der Pythagoreer," *ABG*, 9 (1964), 103-132.
- Ioannidi, H. "Essai de reconstruction de la logique archaïque," *Eirene*, 3 (1964), 5-50.
- . "La place d'Héraclite dans l'histoire de la philosophie grecque," *ibid.*, 5 (1966), 17-41.
- Jaeger, Werner, *The Theology of the Early Greek Philosophers*. Oxford: Clarendon Press, 1947.
- Johnson, H. J. "Three ancient meanings of matter: Democritus, Plato, and Aristotle," *JHI*, 28 (1967), 3-16.
- Joly, R. Review of Furley's *Two Studies in Greek Atomists* in *AC*, 36 (1967), 725-26.
- Jüngel, Eberhard. *Zum Ursprung der Analogie bei Parmenides und Heraklit*. Berlin: Walter de Gruyter, 1964.
- Kahn, Charles H. "Anaximander and the Arguments Concernings the *Apeiron* at *Physics* 203b4-15," *Festschrift Ernst Kapp* (Hamburg: M. von Schröder, 1958), pp. 19-29.
- . *Anaximander and the Origins of Greek Cosmology*. New York: Columbia University Press, 1960.
- . "Religion and Natural Philosophy in Empedocles' Doctrine of the Soul," *AGPh*, 42 (1960), 3-35.
- . "A New Look at Heraclitus," *APQ*, 1 (1964), 189-203.
- . "The Greek Verb 'To Be' and the Concept of Being," *Foundations of Language*, 2 (1966), 245-65.

- Review of Tarán's *Parmenides* in *Gnomon*, 40 (1968), 123-33.
- "Anaximander," *EP*, I, 117-18.
- "Empedocles," *EP*, II, 496-99.
- "The Thesis of Parmenides," *RM*, 22 (1969), 700-24.
- Review of Bollack's *Empédocle*, vol. I, in *Gnomon*, 41 (1969), 439-47.
- Kalton, Michael Charles. "Vat. Fr. #500, An Unknown Synopsis of Greek Philosophy." Unpublished Master's Thesis, Department of Classical Languages, St. Louis University, 1965.
- Kerenyi, C. *Religion of the Greeks and Romans*, transl. C. Holmes. London: Thames and Hudson, 1962.
- Kerferd, G. B. "The Date of Anaximenes," *MH*, 11 (1954), 117-21.
- "Recent Work on Presocratic Philosophers," *APQ*, 2 (1965), 130-40.
- Review of Detienne's *La notion de daimôn* in *CR*, n.s. 15 (1965), 77-79.
- "Anaxagoras," *EP*, I, 115-17.
- Review of Guthrie's *History of Greek Philosophy*, Vols. One and Two, in *CR*, n. s. 14 (1964), 67-70 and 16 (1966), 365-68.
- Review of Gershenson-Greenberg's *Anaxagoras* in *CR*, n.s. 16 (1966), 165-66.
- Review of Mueller's *Gleiches zum Gleichen* in *CR*, 16 (1966), 210-12.
- Review of Tarán's *Parmenides* in *CR*, n.s. 17, (1967), 13-15.
- Review of Bollack's *Empédocle* in *ibid.*, pp. 147-49.
- Review of Cleve's *Giants of Pre-Sophistic Greek Philosophy* in *ibid.*, pp. 182-84.
- Review of Guthrie's *History of Greek Philosophy*, vol. II, in *PR*, 76 (1967), 519-22.
- Review of Lanza's *Anassagora* in *CR*, n.s. 18 (1968), 279-81.
- Review of De Vogel's *Pythagoras and Early Pythagoreanism* in *ibid.*, pp. 282-84.
- Kerschensteiner, Jula. *Kosmos. Quellenkritische Untersuchungen zu den Vorsokratikern*. ("Zetemata," 30.) München: C. H. Beck, 1962.
- Kessler, Marvin. "Union of Body and Soul According to Gueric of Saint Quentin, O.P." Unpublished Master's thesis. Department of Philosophy, St. Louis University, 1962.
- Kirk, G. S. *Heraclitus: The Cosmic Fragments*. Cambridge: University Press, 1954.
- "Some Problems in Anaximander," *CQ*, n.s. 5 (1955), 21-38.
- "Sense and Common-sense in Development of Greek Philosophy," *JHS*, 81 (1961), 105-117.
- Review of Kahn's *Anaximander and the Origins of Greek Cosmology* in *Isis*, 53 (1962), 403-405.
- *Myth.: Its Meaning and Functions in Ancient and Other Cultures*. Berkeley: University of Calif. Press, 1970.
- Kirk, G. S. and Raven, J. E. *The Presocratic Philosophers: A Critical History with a Selection of Texts*. Cambridge: University Press, 1st printing: 1957; 4th: 1963.
- Kleve, K. *Gnosis theon: die Lehre von der natürlichen Gotteserkenntnis in der epikureischen Theologie*. ("Symbolae Osloenses," fasc. suppl. XIX.) Oslo: Universitetsforlaget, 1963.
- Klowski, J. "Das Entstehen der Begriffe Substanz und Materie," *AGPh*, 48 (1966), 2-42.
- "Der historische Ursprung des Kausalprinzips," *AGPh*, 48 (1966), 225-66.
- "Zum Entstehen der Begriffe Sein und Nichts und der Weltentstehungs- und Welterschöpfungstheorien im strengen Sinne," *AGPh*, 49 (1967), 121-48 and 225-54.
- Kneale, W. "Time and Eternity in Theology," *PAS*, 61 (1960-61), 87-108.
- Knight, T. S. "Parmenides and the Void," *Philosophy and Phenomenological*

- Research*, 19 (1959), 526-28.
- Koyré, A. "Influence of Philosophical Trends on the Formulation of Scientific Theories," *Scientific Monthly*, 80 (1955), 107-111.
- Kraus, W. "Das Wesen des Unendlichen bei Anaximander," *RhM*, 93 (1950), 364-79.
- Kröber, Günter. *Wissenschaft und Weltanschauung in der Antike von den Anfängen bis Aristoteles*. Berlin: Deutscher Verlag der Wissenschaften, 1966.
- Kucharski, P. *Étude sur la doctrine pythagoricienne de la tétrade*. Paris: Les Belles Lettres, 1952.
- "L'idée d'infini en Grèce," *RS*, 34 (1954), 5-19.
 - "Les principes des Pythagoriciens et la dyade de Platon," *ArchPhilos*, 22 (1959), 175-91 and 385-431.
 - "Sur la notion pythagoricienne du *kairos*," *RPhilos*, 88 (1963), 141-69.
 - "Anaxagore et les idées biologiques de son siècle," *RPhilos*, 89 (1964), 137-66.
- Lacey, A. R. "The Eleatics and Aristotle on Some Problems of Change," *JHI*, 26 (1965), 451-68.
- Lämmli, Franz. *Vom Chaos zum Kosmos*. Heft 10 of *Schweizerische Beiträge zur Altertumswissenschaft*. Basel: Verlag Friedrich Reinhardt, 1962.
- Lanza, D. "Il pensiero di Anassagora," *Mem. Ist. Lombardo*, 29 (1965), 223-88.
- Lee, Harold N. "Are Zeno's Paradoxes Based on a Mistake?" *Mind*, 74 (1966), 563-70.
- Leinfellner, W. *Die Entstehung der Theorie: Eine Analyse des kritischen Denkens in der Antike*. Freiburg/München: Karl Alber, 1966.
- Leon, P. "Homoeomerics of Anaxagoras," *CQ*, 21 (1927), 133-41.
- Ley, H. de. "Democritus and Leucippus. Two Notes on Ancient Atomism," *AC*, 37 (1968), 520-33.
- Lloyd, G. E. R. "Right and Left in Greek Philosophy," *JHS*, 82 (1962), 56-66.
- Review of Axelos' *Héraclite et la philosophie* in *Gnomon*, 35 (1963), 339-42.
 - "The Hot and the Cold, the Dry and the Wet in Greek Philosophy," *JHS*, 84 (1964), 92-106.
 - "Leucippus and Democritus," *EP*, IV, 450.
 - *Polarity and Analogy: Two Types of Argumentation in Early Greek Thought*. Cambridge: University Press, 1966.
 - "Popper versus Kirk: A Controversy in the Interpretation of Greek Science," *BJPS*, 18 (1967), 21-38.
- Loenen, J. H. "Was Anaximander an Evolutionist?" *Mnemosyne*, 7 (1954), 215-32.
- *Parmenides, Melissus, Gorgias: A Reinterpretation of Eleatic Philosophy*. Assen: Royal Van Gorcum Ltd., 1959.
- Long, A. A. "The Principles of Parmenides' cosmogony," *Phronesis*, 8 (1963), 90-107.
- Review of Mansfeld's *Die Offenbarung des Parmenides* in *PQ*, 16 (1966), 269-70.
 - Review of Tarán's *Parmenides* in *JHS*, 86 (1966), 223-24.
 - "Thinking and Sense-Perception in Empedocles: Mysticism or Materialism," *CQ*, 16 (1966), 256-77.
- Long, H. S. "Unity of Empedocles' Thought," *AJP*, 70 (1949), 142-58.
- Longrigg, J. "Philosophy and Medicine. Some Early Interactions," *HSCP*, 67 (1963), 147-75.
- "A Note on Anaximenes' Fragment 2 Diels-Kranz," *Phronesis*, 9 (1964), 1-4.
 - "Roots," *CR*, 17 (1967), 1-4.
- Luria, S. "Die Infinitesimaltheorie der antiken Atomisten," *Quellen und Studien zur Geschichte der Mathematik*, Abteilung B, Band 2, Heft 2 (1932), 106-185.
- *Anfänge griechischen Denkens*. Aus dem Russischen übertragen von Peter

- Helms. Berlin: Akad. Verlag, 1963.
- Luther, Wilhelm. "Wahrheit, Licht und Erkenntnis in der griechischen Philosophie bis Demokrit," *ABG*, 10 (1966), 1-240.
- Malverne, L. "Aristote et les apories de Zénon," *RMM*, 58 (1953), 80-107.
- Mansfeld, J. *Offenbarung des Parmenides und die menschliche Welt*. Assen: Van Gorcum Ltd., 1964.
- . "Heraclitus on the Psychology and Physiology of Sleep and on Rivers," *Mnemosyne*, 20 (1967), 1-29.
- Masiello, Ralph J. "Aristotle's Homoeomery and the Fragments of Anaxagoras," *TMS*, 46 (1969), 135-40.
- Masson-Oursel, Paul. "L'idée d'infini dans l'Inde et en Chine," *RS*, 34 (1954), 21-25.
- Mathewson, R. "Aristotle and Anaxagoras," *CQ*, n.s. 8 (1958), 67-81.
- Matson, W. I. "The Naturalism of Anaximander," *RM*, 6 (1953), 387-95.
- . "Democritus, Fragment 156," *CQ*, n.s. 13 (1963), 26-29.
- Mau, J. *Zum Problem des Infinitesimalen bei den antiken Atomisten*. 2nd ed.; Berlin: Akad.-Verl., 1957.
- Mayor, D. "Heráclito 'el sombrío'," *Humanidades*, 12 (1960), 295-314.
- . "Heráclito: 'Ekpyrosis'?" *Pensamiento*, 16 (1960), 69-80.
- . "Actualidad de los presocráticos," *Humanidades*, 13 (1961), 193-200.
- McCaslin, S.J., Richard F. "Divine Infinity in Selected Texts of Hugh of St. Cher." Unpublished Master's Thesis, Department of Philosophy, St. Louis University, 1961.
- McDiarmid, J. B., "Theophrastus on Presocratic Causes," *HSCP*, 61 (1953), 85-156.
- McGibbon, D. "The Atomists and Melissus," *Mnemosyne*, 17 (1964), 248-55.
- . "The Religious Thought of Democritus," *Hermes*, 93 (1965), 385-97.
- Melsen, Andrew G. Van. *From Atomos to Atom: The History of the Concept "Atom."* Pittsburgh: Duquesne Press, 1952.
- . "Atomism," *EP*, I, 193-98.
- Merlan, Philip. "Neues Licht auf Parmenides," *AGPh*, 48 (1966), 267-76.
- Miller, Ed. L. Review of Cleve's *Giants of Pre-Sophistic Philosophy* in *CP*, 53 (1968), 303-306.
- Millerd, C. E. *On the Interpretation of Empedocles*. Chicago: University Press, 1908.
- Minar, E. L. Review of Mondolfo's *L'infinito nel pensiero dell'antichità classica* in *AJP*, 79 (1958), 325-26.
- . "Cosmic Periods in Philosophy of Empedocles," *Phronesis*, 8 (1963), 127-45.
- . Review of Gershenson-Greenberg's *Anaxagoras* in *CW*, 58 (1965), 220-21.
- Mora, José Ferrater. "Infinito," *Diccionario de Filosofía* (5th ed.; Buenos Aires: Editorial Sudamericana, 1965), I, 946-58.
- Mondolfo, Rodolfo. *L'infinito nel pensiero dell'antichità classica*. Firenze: "La Nuova Italia" Editrice, 1956.
- . "Evidence of Plato and Aristotle Relating to Ekpyrosis in Heraclitus," *Phronesis*, 3 (1958), 75-82.
- . *Heraclito e Anassimandro. Heracliti B 124 e 126*. ("Studi e Ric. di Storia della Filos.," 30.) Torino: Ed. di Filos., 1959.
- . "La conflagración universal en Heráclito," *Philosophia*, 23 (1959), 14-25.
- . "El sol y las Erinias según Heráclito: Fragn. 94," *Universidad*, 41 (1959), 19-28.
- . "I frammenti del fiume e il flusso universale in Eraclito," *RSF*, 15 (1960), 3-13.
- . *Moralisti greci. La coscienza morale da Omero a Epicuro*. Napoli: Ricciardi, 1960.
- . "Testimonianze su Eraclito anteriori a Platone," *RSF*, 16 (1961), 399-424.

- , "Heráclito y Parmenides," *Cuadernos de Filosofía*, 2 (1961), 5-16.
- , "Discussioni su un testo parmenideo [DK 28B5-6]," *RSF*, 16 (1964), 310-15.
- , "Tecnica e scienza nel pensiero antico," *Athenaeum*, 43 (1965), 279-94.
- Montero, F. "El pensar en la doctrina de Parménides," *Revista de Filosofía*, 17 (1958), 349-62.
- Morrison, J. S. "Parmenides and Er," *JHS*, 75 (1955), 59-68.
- , "Pythagoras of Samos," *CQ*, 50 (1956), 135-56.
- , Review of Burkert's *Weisheit und Wissenschaft in Gnomon*, 37 (1965), 344-54.
- Mourelatos, A. P. D. "The Real, Appearances and Human Error in Early Greek Philosophy," *RM*, 19 (1965), 346-65.
- , "Comments on [C. H. Kahn's] 'The Thesis of Parmenides'," *RM*, 22 (1969), 735-44.
- , *The Route of Parmenides*. New Haven: Yale University Press, 1970.
- Mugler, Ch. Review of Mondolfo's *L'infinito nel pensiero dell'antichità classica* in *RPh*, 31 (1957), 290-92.
- , "Sur l'histoire de quelques définitions de la géométrie grecque et les rapports entre la géométrie et l'optique," *AC*, 26 (1957), 331-45 and 27 (1958), 76-91.
- , "Pluralisme matériel et pluralisme dynamique dans la physique grecque d'Anaximandre à Épicure," *RPh*, 35 (1961), 67-86.
- , "Le retour éternel et le temps linéaire dans la pensée grecque," *BAGB*, 25 (1966), 405-419.
- , "Le *kenon* de Platon et le *panta homou* d'Anaxagore," *REG*, 80 (1967), 210-19.
- , "Kosmologische Formeln," *Hermes*, 96 (1968), 515-26.
- Müller, C. W. *Gleiches zum Gleichen, ein Prinzip frühgriechischen Denkens*. Wiesbaden: O. Harrasowitz, 1965.
- Nélot, G. *Empédocle d'Agrigente*. Bruxelles: Office de Publicité, 1959.
- Neugebauer, Otto. *The Exact Sciences in Antiquity*. Princeton, New Jersey: Princeton University Press, 1952.
- Nicoletti, E. "Dalla trascendentalità dell'essere alla differenza ontologica," *RFNS*, 57 (1965), 284-304.
- Niel, H. "A propos d'Héraclite," *Critique*, 13 (1961), 249-58.
- Nuño-Montes, J. A. "Ser y devenir en la filosofía presocrática," *Revista Nacional de Cultura* (Caracas), 26 (1964), 97-104.
- O'Brien, D. "Empedocles' Fr. 35, 14-15," *CR*, n.s. 15 (1965), 1-4.
- , "Empedocles' Cosmic Cycle," *CQ*, n.s. 17 (1967), 29-40.
- , "Anaximander's Measurements," *ibid.*, 423-32.
- , "The Relation of Anaxagoras and Empedocles," *JHS*, 88 (1968), 93-113.
- , "Derived Light and Eclipses in the Fifth Century," *ibid.*, 88 (1968), 114-27.
- , *Empedocles' Cosmic Cycle*. Cambridge: University Press, 1969.
- O'Brien, James F. "Zeno's Paradoxes of Motion," *TMS*, 40 (1963), 105-138.
- O'Keefe, Martin J. "The Commentaries of Proclus on *Timaeus* 28A." Unpublished MA Thesis, Department of Classical Languages, St. Louis University, 1960.
- Onians, R. B. *The Origins of European Thought About the Body, the Mind, the Soul, the World, Time and Fate*. Cambridge: University Press, 1954.
- Orlando Bedoya, S. "Verdad y opinión. Estudio gnoseológico del poema 'Sobre la naturaleza' de Parménides," *Franciscanum*, 7 (1965), 63-83.
- Owen, G. E. L. "Zeno and the Mathematicians," *PAS*, 58 (1957-58), 199-222 (re-printed in W. C. Salmon, *Zeno's Paradoxes*, pp. 139-63).
- , "Eleatic Questions," *CQ*, n.s. 10 (1960), 84-102.
- , "Plato and Parmenides on the Timeless Present," *Monist*, 50 (1966), 317-40.
- Owens, C.Ss.R., Joseph. "Common Nature: A Point of Comparison Between Thomistic and Scotistic Metaphysics," *MS*, 19 (1957), 1-14.

- . *A History of Ancient Western Philosophy*. New York: Appleton-Century-Crofts, Inc., 1959.
- . Review of Jüngel's *Zum Ursprung der Analogie bei Parmenides und Heraklit* in *TMS*, 43 (1965), 78-80.
- Padellaro, R. *Il problema cosmologico e l'antinomia uno-molteplice. Dai Presocratici ad Aristotele*. Milano: Marzorati, 1962.
- Padovani, U. A. *Grande Antologia Filosofica*. Vols. 1-2 of "Il Pensiero Classico." Milano: Carlo Marzorati, 1954.
- Padrón, H. J. "Acerca de una nueva interpretación del fragmento de Anaximandro," *Philosophia*, 34 (1968), 79-86.
- Paisse, J. M. "Les rapports de Platon et de la philosophie présocratique," *Les Etudes Classiques*, 34 (1966), 321-39 and 35 (1967), 15-33.
- Palmer, L. M. Review of Tarán's *Parmenides* in *AJP*, 89 (1968), 364-68.
- Prather, Jean. "Divine Infinity in Selected Texts From Saint Bonaventure's Commentary on the *Sentences*." Unpublished Master's Thesis, Department of Philosophy, St. Louis University, 1964.
- Peck, A. L. "Anaxagoras' Predication as a Problem in Physics," *CQ*, 25 (1931), 27-37 and 112-20.
- Penati, G. "Appunti metodologico-critici circa il contenuto del senso dell'essere," *RFNS*, 57 (1965), 278-83.
- Peters, F. E. *Greek Philosophical Terms: A Historical Lexicon*. New York: University Press, 1967.
- Phillips, E. D. "Parmenides on Thought and Being," *PR*, 64 (1955), 546-60.
- Phillip, J. A. "The Fragments of the Presocratic Philosophers," *Phoenix*, 10 (1956), 116-23.
- . "The Biographical Tradition: Pythagoras," *TAPA*, 90 (1959), 185-94.
- . "Aristotle's Monograph On the Pythagoreans," *TAPA*, 94 (1963), 185-98.
- . "Aristotle's Sources for Pythagorean Doctrine," *Phoenix*, 17 (1963), 251-65.
- . "Pythagorean Theory of Derivation of Magnitudes," *ibid.*, 20 (1966), 32-50.
- . *Pythagoras and Early Pythagoreanism*. Toronto: University of Toronto Press, 1966.
- Pirenne, J. "L'influence égyptienne sur la philosophie ionienne," *AlPhO*, 15 (1958-1960), 75-82.
- Popma, K. "De Kennis omtrent de antieke Cultuur," *TPh*, 22 (1960), 441-76.
- Popper, K. R. "Back to the Presocratics," *PAS*, 59 (1958-59), 1-24.
- . "Kirk on Heraclitus, and on Fire as Cause of Balance," *Mind*, 72 (1963), 386-92.
- Poulet, G. "Le symbole du cercle infini dans la littérature et la philosophie," *RMM*, 63 (1959), 257-75.
- Pozsgay, Lawrence J. "Zeno's Achilles Paradox," *TMS*, 43 (1966), 375-95.
- Préaux, C. "L'élargissement de l'espace et du temps dans la pensée grecque," *Bulletin de la Classe des Lettres de l'Académie Royale de Belgique*, 54 (1968), 208-267.
- Pró, Diego, F. "Interpretación del ser en la filosofía griega," *Humanitas*, 1 (1953), 41-97.
- . "Influencias orientales en la formación del pensamiento griego," *Philosophia*, 33 (1967), 19-37.
- Ramnoux, Cl. "Sur quelques interprétations modernes d'Anaximandre," *RMM*, 59 (1954), 233-52.
- . *Vocabulaire et structures de pensée archaïque chez Héraclite*. Paris: Les Belles Lettres, 1959.
- . *La Nuit et les enfants de la nuit dans la tradition grecque*. Paris: Flammarion, 1959.
- . "Études présocratiques," *RPhilos.*, 86 (1961), 93-107.

- . "Études présocratiques," *ibid.*, 87 (1962), 76-89.
- . "Pourquoi les présocratiques?" *RPhL*, 66 (1968), 397-419.
- Raven, J. E. *Pythagoreans and Eleatics: An Account of the Interaction Between the Two Opposed Schools During the Fifth and Early Fourth Centuries B.C.* Cambridge: University Press, 1948.
- . "Basis of Anaxagoras' Cosmology," *CQ*, n.s. 4 (1954), 123-37.
- Raven, J. E. and G. S. Kirk. *The Presocratic Philosophers. A Critical History with A Selection of Texts.* Cambridge: University Press, [4th printing] 1963.
- Reesor, M. E. "The Meaning of Anaxagoras," *CP*, 55 (1960), 1-8.
- . Review of Lanza's *Anassagora* in *Gnomon*, 40 (1968), 192-93.
- . Review of Hölscher's *Anfängliches Fragen* in *Gnomon*, 41 (1969), 721-28.
- Reinhardt, Karl. *Parmenides und die Geschichte der griechischen Philosophie.* 2nd ed.; Frankfurt a. M.: Klostermann, 1959.
- Renou, L. "Cosmogonies et mythologies orientales," *Critique*, 16 (1960), 466-72.
- Rescher, Nicholas. "Cosmic Evolution in Anaximander," *Studium Generale*, 11 (1958), 718-31.
- Riezler, Kurt. *Parmenides.* Frankfurt am Main: Vittoria-Klostermann, 1934.
- Rist, John M. "Monism, Plotinus and Some Predecessors," *HSCP*, 69 (1965), 329-44.
- . Review of Furley's *Two Studies in Greek Atomists* in *Phoenix*, 21 (1967), 232-33.
- Robin, Léon. *Greek Thought and the Origins of the Scientific Spirit*, transl. M. R. Dobie. New York: Russell and Russell, 1967.
- Romano, Francesco. *Anassagora.* Padova: Casa Editrice Dott. Antonio Milani, 1965.
- Rozelaar, M. "L'aube de la logique. Le passage du mythe au logos dans la pensée grecque" [title and article in Hebrew, with English résumé, pp. 112-110], *Iyyun*, 11 (1960), 1-13.
- Russell, Bertrand. *Principles of Mathematics.* 2nd ed.; New York: W. W. Norton and Company, Inc., 1937.
- . *Our Knowledge of the External World.* London: George Allen and Unwin, Ltd., 1961.
- . *History of Western Philosophy.* London: George Allen and Unwin, Ltd., 1961.
- Ryle, Gilbert. "Achilles and the Tortoise," *Dilemmas* (Cambridge: University Press, 1954), pp. 36-53.
- Saffrey, H. D. "Bulletin d'histoire de la philosophie ancienne." *RSPH*, 44 (1960), 98-110.
- Salmon, Wesley C. *Zeno's Paradoxes* ("Library of Liberal Arts.") New York: Bobbs-Merrill, 1970.
- Samson, A. "Aristote et les théories présocratiques sur la connaissance," *LThPh*, 22 (1966), 22-44.
- Sarton, G. *A History of Science: Ancient Science Through the Golden Age of Greece.* Cambridge: University Press, 1962.
- Sambursky, Samuel. *The Physical World of the Greeks*, transl. Merton Dagut. New York: Macmillan Company, 1956.
- Schaerer, R. *L'homme antique et la structure du monde intérieur d'Homère à Socrate.* Paris: Payot, 1958.
- Schick, T. "Check & Spur: Parmenides' Concept of (What) is," *CJ*, 60 (1965), 170-73.
- Schramm, Matthias. *Die Bedeutung der Bewegungslehre des Aristoteles für seine beiden Lösungen der zenonischen Paradoxie.* ("Philosophische Abhandlungen," Band 19.) Frankfurt am Main: Vittoria Klostermann, 1962.
- Schramm, H.-P. "Zur Geschichte des Wortes 'obligatio' von der Antike bis Thomas von Aquin." *ABG*, 11 (1967), 119-47.

- Schuhl, P.-M. Review of Ramnoux's *La Nuit et les enfants* in *RPhilos*, 87 (1962), 392-95.
- Schwabl, Hans. "Sein und Doxa bei Parmenides," *Wiener Studien*, 66 (1953), 50-75.
- . "Weltschöpfung," *RE*, Supplementband, IX (1962), cols. 1433-1582 – on Presocratics, cols. 1515-1539.
- . "Hesiod und Parmenides: Zur Formung des parmenideischen Prooimions (28 B 1)," *RhM*, 106 (1963), 134-42.
- . "Anaximander. Zu den Quellen und seiner Einordnung im vorsokratischen Denken," *ABG*, 9 (1964), 59-72.
- . Review of C. H. Kahn's *Anaximander* in *Gnomon*, 37 (1965), 225-28.
- Seeck, G. A. Review of Guthrie's *History of Greek Philosophy*, Vol. II, in *Gnomon*, 38 (1966), 529-38.
- Seidel, G. J. *Martin Heidegger and Presocratics. An Introduction to His Thought*. Lincoln: University of Nebraska Press, 1964.
- Seligman, Paul. *The Apeiron of Anaximander. A Study in the Origin and Function of Metaphysical Ideas*. London: University of London Athlone Press, 1963.
- Severino, E. "Ritornare a Parmenide," *RFNS*, 56 (1964), 137-75. [For comments on this article, see entries Bacchin, Bausola, Bontadini, Giacon, Nicoletti, Penati, Sirchia].
- Sichirrollo, L. "Quelques études récentes dans le domaine de la philosophie grecque," *Critique*, 19 (1963), 354-67.
- Siegel, R. E. "Parmenides and the Void. Some Comments on the Paper of Thomas S. Knight," *Philosophy and Phenomenological Research*, 22 (1961), 264-66.
- Sinnige, T. G. *Matter and Infinity in the Presocratic Schools and Plato*. Assen: Van Gorcum and Co., 1968.
- Sirchia, F. "Ritornare a Parmenide o ai Megarici?" *RFNS*, 57 (1965), 322-26.
- Skemp, J. B. Review of Jüngel's *Zum Ursprung der Analogie bei Parmenides und Heraklit* in *JHS*, 87 (1967), 165.
- Smiley, C. N. Review of Mondolfo's *L'infinito nel pensiero dell'antichità classica* in *CJ*, 32 (1937), 370-71.
- Snell, Bruno. *The Discovery of the Mind: Greek Origins of European Thought*. Transl. T. G. Rosenmeyer. Cambridge, Mass.: Harvard University Press, 1953.
- Solmsen, Friedrich. "Tissues and the Soul," *PR*, 59 (1950), 435-68.
- . "Chaos and Apeiron," *SIFC*, 24 (1949-1950), 235-48.
- . "Aristotle and Presocratic Cosmogony," *HSCP*, 63 (1958), 265-82.
- . *Aristotle's System of the Physical World: A Comparison with his Predecessors*. Ithaca, New York: Cornell University Press, 1960.
- . "Greek Philosophy and the Discovery of the Nerves," *MH*, 18 (1961), 140-97.
- . "Anaximander's Infinite," *AGPh*, 44 (1962), 109-131.
- . "Nature as Craftsman in Greek Thought," *JHI*, 24 (1963), 473-96.
- . "Love and Strife in Empedocles' Cosmology," *Phronesis*, 10 (1965), 109-148.
- . Review of Schramm's *Die Bedeutung der Bewegungslehre* in *Gnomon*, 38 (1966), 150-57.
- . Review of Bollack's *Empédocle*. Vol. I, in *CP*, 63 (1968), 238-41.
- Somigliano, A. "Le figurazione allegoriche del 'Proemio' di Parmenide," *Sophia*, 33 (1965), 301-310.
- . "Cosmogonie orientali e filosofia presocratica," *ibid.*, 36 (1968), 212-23.
- . "Come interpretare in Parmenide l'equivalenza tra 'sentire' e 'pensare'," *ibid.*, 37 (1969), 83-86.
- Sprague, R. K. Review of Tarán's *Parmenides* in *CP*, 61 (1966), 262-63.
- Stannard, Jerry. "Parmenidean Logic," *PR*, 69 (1960), 526-33.
- . "The Presocratic Origin of Explanatory Method," *PQ*, 15 (1965), 193-206.

- Stapleton, H. E. "Ancient and Modern Aspects of Pythagoreanism," *Osiris*, 13 (1958), 12-53.
- Stogre, Michael. "Mathematics and the Paradoxes of Zeno: A Rejoinder to Lawrence Pozsgay," *TMS*, 45 (1968), 313-19.
- Stokes, M. C. "Hesiodic and Milesian Cosmogonies," *Phronesis*, 7 (1963), 1-35 and 8 (1963), 1-34.
- . "On Anaxagoras: I: Anaxagoras' Theory of Matter; II: Order of Cosmogony," *AGPh*, 47 (1965), 1-19 and 217-50.
- . Review of Guthrie's *History of Greek Philosophy*, vols. I and II, in *PQ*, 15 (1965), 65-67 and 17 (1967), 164-66.
- Strough, C. L. "Parmenides' Way of Truth B8.12-13," *Phronesis*, 13 (1968), 91-107.
- Strang, C. "The Physical Theory of Anaxagoras," *AGPh*, 45 (1963), 101-118.
- . Review of Gershenson-Greenberg's *Anaxagoras in Isis*, 56 (1965), 473-74.
- Strodach, George K. *The Philosophy of Epicurus*. Chicago: Northwestern University Press, 1963.
- Sweeney, S.J., Leo. "Are *Apeiria* and *Aoristia* Synonyms?" *TMS* 33 (1956), 270-79.
- . "Some Mediaeval Opponents of Divine Infinity," *MS*, 19 (1957), 233-46.
- . "Infinity in Plotinus," *Gregorianum*, 38 (1957), 515-35 and 713-32.
- . "Divine Infinity: 1150-1250," *TMS*, 35 (1957), 38-51.
- . "Lombard, Augustine and Infinity," *Manuscripta*, 2 (1958), 24-40.
- . "Divine Infinity According to Richard Fishacre," *TMS*, 35 (1958), 191-212.
- . "*Idealis* in the Terminology of Thomas Aquinas," *Speculum*, 33 (1958), 497-507.
- . "Research Difficulties in the *Liber de Causis*," *TMS*, 36 (1959), 109-116.
- . "Plotinus Revisited," *Gregorianum*, 40 (1959), 327-31.
- . "Doctrine of Creation in the *Liber de Causis*," *Etienne Gilson Tribute*, Ed. Charles J. O'Neil. Milwaukee: Marquette University Press, 1959. Pp. 274-89.
- . "L'infini quantitatif chez Aristote," *RPhL*, 58 (1960), 505-528.
- . "John Damascene and Divine Infinity," *NS*, 35 (1961), 76-106.
- . "Another Interpretation of *Enneads*, VI, 7, 32," *TMS*, 38 (1961), 289-303.
- . "Basic Principles in Plotinus' Philosophy," *Gregorianum*, 52 (1961), 506-516.
- . "John Damascene's 'Infinite Sea of Essence'," *Studia Patristica*: Papers presented to the Third International Conference on Patristic Studies held at Christ Church, Oxford, 1959. Vol. IV. Ed. Kurt Aland and F. L. Cross. (Texte und Untersuchungen zur Geschichte der altchristlichen Literatur). Berlin: Akademie-Verlag, 1962. Pp. 294-309.
- . "Neo-Platonism," *Collier's Encyclopedia* (New York: P. F. Collier and Son, 1961), XVII, 297-98.
- . "Analogy and Being," *TMS*, 39 (1962), 251-62.
- . "Metaphysics and God: Plotinus and Aquinas," *Miscellanea Mediaevalia*, Vol. 2: *Die Metaphysik im Mittelalter ihr Ursprung und ihre Bedeutung*. Berlin: Walter de Gruyter and Co., 1963. Pp. 232-39.
- . "Transcription of Initial Folios of *Summa de Bono*, Codex Vaticanus Latinus 4305," *Manuscripta*, 7, (1963), 131-57.
- . "Existence/Essence in Thomas Aquinas' Early Writings," *Proceedings of American Catholic Philosophical Association*, 37 (1963), 97-131.
- . *A Metaphysics of Authentic Existentialism*. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1965.
- . "The Origin of Participant and of Participated Perfections in Proclus' *Elements of Theology*," *Wisdom in Depth: Essays in Honor of Henri J. Renard*. Milwaukee: Bruce Publishing Company, 1966. Ch. 15, pp. 235-65.
- . "*Summa de Bono*, Codex Vat. Lat. 4305: Transcription of Folios 4r-7(bis)r," *Manuscripta*, 9 (1965), 30-52.

- . "Existentialism: Authentic and Unauthentic," *NS*, 40 (1966), 36-61.
- . "The Mystery of Existence," *TMS*, 44 (1966), 57-73.
- . "Five Platonic Studies," *TMS*, 44 (1967), 375-81.
- . "John Damascene," *EP*, IV, 279-80.
- . "Infinity," *NCE*, VII, 504-508.
- . "Infinity of God," *ibid.*, VII, 508-509.
- . "Liber de Causis," *ibid.*, VIII, 693-94.
- . "Proclus," *ibid.*, XI, 825.
- . "Human Knowledge According to Gueric of St. Quentin, O.P.," *Arts libéraux et philosophie au moyen âge* (Actes du Quatrième Congrès International de Philosophie Médiévale; Montréal, 1967). Montréal: Institut d'Études Médiévales, 1969. Pp. 1129-41.
- . "Infinity," *Encyclopedia Americana*, 15 (1969), 150-51.
- . "Aquinas or Philosophers of Subjectivity?" *TMS*, 46 (1969), 57-70.
- . "More Books on Plato," *ibid.*, 47 (1970), 225-37.
- . "Philosophy," *Dictionary of Theology*, Ed. John Bradley (Raleigh, North Carolina: Good Will Publishers, Inc., 1971).
- . Review of Wass' *The Infinite God and the "Summa Fratris Alexandri"* in *IPQ*, 6 (1966), 139-43.
- . Review of Bobik's *Aquinas on Being and Essence* in *TMS*, 45 (1968), 145-47.
- . Review of Tarán's *Parmenides* in *ibid.*, pp. 163-65.
- . Review of Wolter's *Scotus: A Treatise on God as First Principle* in *ibid.*, pp. 345-47.
- . Review of Balás' *Metousia Theou: Man's Participation in God's Perfections According to Saint Gregory of Nyssa* in *ibid.*, 46 (1968), 57-59.
- . Review of Rist's *Plotinus: The Road to Reality* in *CJ*, 64 (1969), 180-83.
- . Review of Wheelwright's *The Presocratics* in *TMS*, 46 (1969), 165-67.
- . Review of Parker's *A Short Account of Greek Philosophy* in *ibid.*, 182-83.
- Szabó, Á. "Die Grundlagen in der frühgriechischen Mathematik," *SIFC*, 30 (1958), 1-51.
- Tannery, Paul. "Le concept scientifique du continu. Zénon d'Elée et Georg Cantor," *Revue philosophique de la France et de l'étranger*, 20 (1885), 385-410.
- . *Pour l'histoire de la science hellène*. Paris: Gauthier-Villars, 1887; 2nd ed.: 1930.
- . "Pour l'histoire du mot 'apeiron'," *Revue de philosophie*, 5 (1904), 703-707.
- Tarán, Leonardo. *Parmenides, A Text with Translation, Commentary and Critical Essays*. Princeton, New Jersey: University Press, 1965.
- . "El Significado de *noein* en Parménides," *AFC*, 7 (1959), 122-39.
- . "El concepto de lo divino en Jenófanes," *Philosophia*, 22 (1959), 10-25.
- Tate, J. Review of Mondolfo's *L'infinito nel pensiero dell'antichità* in *CR*, 8 (1958), 169-71.
- Taylor, A. E., "Two Pythagorean Philosophemes: I. The Connexion to *artion* and bisection ad indefinitum," II. The One and the 'Gnomons'," *CR*, 40 (1926), 149-51.
- Taylor, C. C. W. "Pleasure, Knowledge and Sensation in Democritus," *Phronesis*, 12, (1967), 6-27.
- Thesleff, Holger. *An Introduction to the Pythagorean Writings of the Hellenistic Period*. ("Acta Academiae Aboensis Humaniora," XXIV, 3.) Abo: Abo Akademi, 1961.
- Thomson, G. "From Religion to Philosophy," *JHS*, 73 (1953), 77-83.
- Thomson, J. "Infinity in Mathematics and Logic," *EP*, IV, 185-89.
- Timpanaro Cardini, M. "Una dottrina pitagorica nella testimonianza aristotelica," *Physis*, 3 (1961), 105-112.

- Toulmin, S. and Goodfield, J. *The Architecture of Matter*. London: Hutchinson, 1962.
- Tugwell, S. "The 'Way of Truth,'" *CQ*, 14 (1964), 36-41.
- Tumarkin, A. "Der Begriff des *apeiron* in der griechischen Philosophie," *ASSPh*, 3 (1943), 55-71.
- Untersteiner, M. "Ancora su Parmenide (Die Fragm. d. Vorsokr. 28 B8, vv. 5-6)," *RSF*, 20 (1965), 50-52.
- Ushenko, A. "Zeno's Paradoxes," *Mind*, 55 (1946), 151-65.
- Valle, A. "Logos di Eraclito," *Revista Rosminiana di Filosofia*, 58 (1964), 121-27.
- Vallejos, R. "El concepto de la medida en el pensamiento griego," *Virtud Let. Colomb.*, 15 (1956), 55-63.
- Verdenius, W. J. *Parmenides: Some Comments on His Poem* (Groningen: J. B. Wolters, 1942).
- . "Empedocles' Doctrine of Sight," *Studia varia Carolo Guilielmo Vollgraff o Discipulis Oblata* (Amsterdam: A. M. Hakkert, 1948), pp. 155-64.
- . "Melissus Fr. 2," *Mnemosyne*, 1 (1948), 8-10.
- . "Parmenides' Conception of Light," *ibid.*, 2 (1949), 116-31.
- . "Parmenides B 2, 3," *ibid.*, 15 (1962), 237.
- . "Der Logosbegriff bei Heraklit und Parmenides," *Phronesis*, 6 (1966), 81-98.
- Vernant, J.-P. "Géométrie et astronomie sphérique dans la première cosmologie grecque," *Pensée*, 109 (1963), 82-92.
- Vlastos, Gregory. "Parmenides' Theory of Knowledge," *TAPA*, 77 (1946), 66-77.
- . "Equality and Justice in Early Greek Cosmologists," *CP*, 42 (1947), 156-78.
- . "The Physical Theory of Anaxagoras," *PR*, 59 (1950), 31-57.
- . "Theology and Philosophy in Early Greek Thought," *PQ*, 2 (1952), 92-132.
- . Review of Zafiropoulos's *L'École Éleate* in *Gnomon*, 25 (1953), 166-69.
- . Review of J. E. Raven's *Pythagoreans and Eleatics* in *ibid.*, 25 (1953), 29-35.
- . Review of Cornford's *Principium Sapientiae* in *Gnomon*, 27 (1955), 56-76.
- . "On Heraclitus," *AJP*, 76 (1955), 337-68.
- . Review of Kirk-Raven's *Presocratic Philosophers* in *Gnomon*, 31 (1959), 532-35.
- . Review of Fränkel's *Wege und Formen frühgriechischen Denkens* in *ibid.*, 31 (1959), 193-204.
- . "Zeno of Elea," *EP*, VIII, 369-79.
- . "A Note on Zeno's Arrow," *Phronesis*, 11 (1966), 3-18.
- . "Zeno," *Philosophic Classics*, ed. W. Kaufmann (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., [2nd ed.] 1968), I, 22-31.
- Waerden, B. L. van der. *Science Awakening*, transl. Arnold Dresden. Groningen: P. Noordhoff Ltd., 1954.
- . "Pythagoras," *RE*, Supplementband X (1965), cols. 843-64.
- . *Erwachende Wissenschaft, Ägyptische, Babylonische und Griechische Mathematik*. 2nd ed.; Basel: Birkhäuser Verlag, 1966.
- Wasserstein, A. "Thales' Determination of the Diameters of the Sun and Moon," *JHS*, 75 (1955), 114-16 and 76 (1956), 105.
- . Review of Sambursky's *Physics of the Stoics* in *JHS*, 83 (1963), 186-90.
- Weizsäcker, C. F. von. *The World-View of Physics*, transl. Marjorie Grene. Chicago: University Press, 1952.
- . *The Relevance of Science: Creation and Cosmogony*. London: Eaton, 1964.
- West, M. L. "Three Presocratic Cosmologies," *CQ*, n.s. 13 (1963), 154-76.
- . "Alcman and Pythagoras," *ibid.*, 17 (1967), 1-15.

- Whitrow, G. J. *The Natural Philosophy of Time*. London: Thomas Nelson and Sons Ltd., 1961. (On Zeno's Paradoxes, pp. 135-52).
- Whyte, L. L. *Essay on Atomism: From Democritus to 1960*. New York: Harper and Row, 1961.
- Wiersma, W. "Notes on Greek Philosophy," *Mnemosyne*, 20 (1967), 403-408.
- Wilford, F. A. "Embryological Analogies in Empedocles' Cosmogony," *Phronesis*, 13 (1968), 108-118.
- Wiśniewski, B. "Sur la signification de l'*apeiron* d'Anaximandre," *REG* 70 (1957), 47-55.
- . "*Apeiron* d'Anaximandre et de Pythagore," *SIFC*, 31 (1959), 175-78.
- . "Sur la signification du *eon* et de la *doxa* chez Parménide," *RIL*, 98 (1964), 63-68.
- Wolf, E. "Der Ursprung des abendländischen Rechtsgedankens bei Anaximander und Heraklit," *Symposium*, 1 (1948), 35-87.
- . "*Dike* bei Anaximander und Parmenides," *Lexis*, 2 (1949), 16-24.
- Woodbury, L. "Parmenides on Names," *HSCP*, (1958), 145-60.
- Yoshioka, K. "An Interpretation of Anaximander," *Histoire de la philosophie: Méthodologie, antiquité et moyen âge. (Actes XI Congr. Internatl. de Philosophie.)* Amsterdam: Noord-Holl. Uitg. Maatsch., 1953. Pp. 51-53.
- Zafiropulo, J. *Anaxagore de Clazomène* ("Coll. Études anciennes.") Paris: Les Belles Lettres, 1948.
- . *Diogène d'Apollonie*. Paris: "Les Belles Lettres," 1956.
- Zeller, E. e R. Mondolfo. *La Filosofia dei Greci nel suo sviluppo storico*. Parte Prima: *I Presocratici*. Vol. I: *Origini, caratteri e periodi della filosofia greca*; Vol. II: *Ionici e Pitagorici*; Vol. III: *Eleati*; Vol. IV: *Eraclito*. Firenze: "La Nuova Italia" Editrice, 1951, 1950 and 1961.
- Zeppi, S. "Intorno al pensiero di Senofane," *RSF*, 16 (1961), 385-98.
- . "L'antiplurismo di Melisso," *ibid.*, 17 (1962), 321-27.

Addenda:

- De Cecchi Duso, Gianna. *L'interpretazione Heideggeriana dei Presocratici*. Padova: CEDAM, 1970.
- De Vogel, C. J. *Theoria: Studies over de Griekse Wijsbegeerte*. Assen: Van Gorcum, 1967.
- . *Philosophia*. Part I: *Studies in Greek Philosophy*. Assen: Van Gorcum, 1970.
- Marcovich, M. "What Heraclitus Said," *Proceedings of the Seventh Inter-American Congress of Philosophy* (Quebec: Les Presses de l'Université Laval, 1967), 1, 301-313.
- Stokes, M. C. *One and Many in Presocratic Philosophy*. Washington: Center for Hellenic Studies, 1971.
- West, M. L. *Early Greek Philosophy and the Orient*. Oxford: Clarendon Press, 1971.

INDEX OF TOPICS

A page-number accompanied by the letter 'n' in roman type indicates a footnote; a page-number accompanied by the letter 'n' in italics indicates body of text and footnote. My thanks to Elizabeth Reilly, who typed this Index.

- Absolute Nature, 105n
 Actuality/potentiality (*see also* Infinity)
 re finitude/infinity (Aristotle), XXIX
 (Sinnige), 120-21n, 122, 166
Adikia: Injustice (Anaximander's Fragment), 3, 5 (Vlastos), 6 (Jaeger), 7 (Burch), 9 (Cherniss), 11 (Cornford), 13 (McDiarmid), 15 (Hölscher), 18 and 19 (Kirk), 24 (Kahn), 28 (Classen), 30-33 (Seligman), 41 (Cleve), 52, 183-84 (Guariglia)
Aer: Air (Anaximenes), 67 (Texts I-V)
 as *apeiros*:
 monism, 81
 summary of meanings, 68
 surrounds world, 42-43 (Stokes), 44-45 (no: Bicknell), 68
 without primacy, 68, 73
 rarefaction/condensation, 68, 69
 summary of attributes, 68
Aither, 71-72n (*see also* Fire)
 Ancient sources on Anaximander, 2-5
To apeiron: The infinite (Anaximander), 2-49, 51-52, 55-65, 175-76 (*see also Adikia*; *Arche*; *Kosmoi*; God in Anaximander; *To gonimon*; *Innumerable worlds*; "Opposites"; *Ouranoi*; Time)
 actual *vs.* potential (Aristotle), 175n
re Anaximander's predecessors:
 Babylonian astronomers, 22 (Kahn), 90n
 Hesiod, 9 (Cherniss), 15-16 (Hölscher), 28 (Classen), 32-33 (Seligman), 39 (Gottschalk), 41-44 (Stokes), 52-53, 55-56, 182 (Conti)
 mythical cosmogonies of Orient, 181 (Conti)
 Sanchunjaton, 15-16 (Hölscher), 55
re Anaximenes' *apeiron aer*, 15 and 16 (Hölscher), 34 (Guthrie), 42-44 (Stokes), 45 and 48-49 (Bicknell)
 Aristotle's five meanings, 10 (Cornford: six), 35 (Guthrie), 46-47 (Bicknell), 170
 given primacy by Anaximander, 2, 51 (Solmsen), 65, 155n, 175-76
 intermediate substance (Aristotle), 15 (no: Hölscher), 17 (Kirk), 20 (no: Wiśniewski), 24 (Kahn), 29 (no: Classen), 30 (no: Seligman), 37 (Gottschalk), 52
 interpretations:
 aoriston, XXVIII (no: Sinnige), XXX, 6 (Jaeger), 11 (no: Cornford), 13 (McDiarmid), 19 (Kirk), 20 (Wiśniewski), 29 (no: Classen), 35 (Guthrie), 39 (Gottschalk), 40 (Cleve), 43 (Stokes), 46 and 48 (Bicknell), 51, 61, 175n, 180 (Carbonara Naddei), 182 (Conti)
 a body, physical mass, 8 (no: Kraus), 24 (Kahn), 29 (Classen), 30 (not mere body: Seligman), 36 (Guthrie), 37 (Gottschalk), 52, 56, 180 (Carbonara Naddei), 182 (Conti)
 imperceptible, 16 (Hölscher: "Begrifflichkeit"), 19n (Kirk), 34 (Guthrie), 38 and 61n (Gottschalk), 62n, 68-69

- intraversable, 25 (Kahn), 27 (Solmsen), 30 (Seligman), 48 and 59 (Bicknell), 60, 61-62, 175
- monistic, 30 (and dualistic: Seligman), 35 (Guthrie), 37 and 38 (Gottschalk), 52, 58, 63-65, 107-108, 180 (not if interpreted dialectically: Carbonara Naddei) (*see also* Pluralism)
- perfection, 26 (Guazzoni Foà), 57n, 65, 134
- spatial infinity, 11 (no: Cornford), 19 (Kirk), 24-25 (Kahn), 29 (Classen), 30 (Seligman), 35 (Guthrie), 59-60, 182 (Conti)
- sphere, 10 (Cornford), 24 (no: Kahn), 30 (no: Seligman), 35 (Guthrie), 48 (Bicknell), 52, 62n, 142n (*see also* Sphere)
- surrounding, steering all things, 10 (Cornford), 12 (Matson), 19 (Kirk), 24-25 (Kahn), 27 (Solmsen), 29 (no: Classen), 35 (Guthrie), 37 and 39 (Gottschalk), 40 (Cleve), 43 (Stokes), 44-48 and 59 (no: Bicknell), 59-61 (*vs.* Bicknell), 175, 180 (Carbonara Naddei)
- temporally everlasting, 22 and 25, (Kahn), 28 (Solmsen), 35 (Guthrie) 62, 175, 182 (Conti)
- "that outside of which there is nothing" (Aristotle), 27 (Solmsen), 170-73 (*re* Atomists), 175
- interpreted
 - dialectically, 180-81 (Carbonara Naddei)
 - through medical writers, 5 (Vlastos)
- moving cause, 11 (Cornford), 25 (Kahn), 27-28 (Solmsen), 30 and 32 (Seligman), 35-36 (Guthrie), 37 (Gottschalk), 56, 62-65, 175, 180 (Carbonara Naddei)
- summary of attributes, 8 (Kraus), 10-11 (Cornford), 16-17 (Hölscher), 19 (Kirk), 24-26 (Kahn), 28-29 (Classen), 32 (Seligman), 38-39 (Gottschalk), 48 (Bicknell), 61-65, 134, 175, 180-81 (Carbonara Naddei), 181-82 (Conti)
- Apeiron* excluded by Heraclitus, 70-72, 73
- Apeiron*: Infinite, limitless:
 - Pythagoras:
 - re* Anaximander's *to apeiron*, 89n-90n, 91n, 176
 - re* Anaximenes' *aer*, 91-92n
 - linked with void, breath, time, 80-81, 90-92, 96, 176
 - Xenophanes: *re* earth, suns, moons, 69-70, 73
- Apeiros aer*: Infinite air (Anaximenes) (*see also* God; Chaos; "Crystalline substance"; Monistic tendencies):
 - re* Anaximander's *to apeiron*, 42-44 (Stokes), 48-49 (Bicknell), 68-69
 - re* Anaximenes' predecessors: Hesiod, 41-44 (Stokes)
- Apeiron/peras* (Pythagoras), 74-92
 - even/odd, 79
 - material/formal, 81
 - reactivated by Plato, XXIX (Sinnige)
- Arché* (Anaximander's *to apeiron*), 6 (Jaeger), 9 (Cherniss), 10 (Cornford), 17 (Kirk), 20-21 (Kahn), 23 (Kahn), 29 (Classen; Seligman), 34 (Guthrie), 51
- Arguments against plurality (Zeno), XXVIII (Sinnige), 121-24, 149-50
- ἀτέλειστον (Parmenides, Fr. 8, 4):
 - emended by Tarán: ἡδὴ τελεστόν, XXX, 105n
 - signifies:
 - Guazzoni Foà: "infinito" because "non ulteriormente perfezionabile," 26
 - Loenen:
 - without end in time because outside time, 101, 126
 - Mondolfo:
 - temporally and spatially limitless, XXVI-XXVII, 110n
 - Sinnige:
 - "all-embracing, endlessly extended," XXVIII, XXX, 105n, 110n
- Atoms (Leucippus, Democritus): 157, 158
 - infinite in number, in shape, XXX, 158n
 - indivisible because of smallness, compactness, impassibility, freedom from void, 158
- Atoms in modern physics, 168n
- Being ("What is"):
 - Melissus:
 - corporeal plenum, 125 (Burnet)
 - corporeal yet non-spatial (Raven), 125
 - incorporeal (Vlastos), 125n, 127
 - incorporeal quantity (Loenen), 126

- infinite in temporal and spatial expansion, 131n, 134-35n
 - not a sphere, 134, 143 (*see also* Sphere)
 - somehow corporeal and spatial (Guthrie), 126
 - without body and bulk yet an indivisible plenum (Owens), 127
- Parmenides, 94, 110, 169n, 177 (*see also* Parmenidean Being; *Peras*); analogy with modern physics, 97 (Guthrie)
- Being *vs.* existence (Atomists *re* void), 156n
- Canons established by Parmenides, 136-37 (Guthrie)
- Chaos (Hesiod), 16 (Hölscher), 28n (Classen, etc.),
 - re* Anaximander's *to apeiron*, 9 (no: Cherniss), 42-44 (Stokes), 48 (Bicknell), 58, 182 (Conti)
 - re* Anaximenes' *apeiros aer*, 43-44 (Stokes)
- Cinematograph:
 - Bergson, 113, 114n
 - De Boer, 116
 - Russell, 114
- Coming-to-be/perishing:
 - Anaxagoras: only apparent, 146-47, 157, 177
 - Atomists: only locomotion exists, 157, 158, 178
 - Empedocles: impossible strictly, 137, 138, 157
- Continuum defined:
 - a compact series of formal factors (Russell), 114-15
 - continuous (*vs.* dense) series of rational and irrational numbers (Lee), 117-19
 - succession without distinction (Bergson), 113-14
 - whole any two parts of which actually have boundary in common (Aristotle), 119, 166, 168, 170
 - whole whose parts are not actually distinct, (De Boer), 116, 119
- Controversies:
 - on Anaxagoras, 144-46
 - re* Mind: whether material and divine, 144-45n, 154n
 - re* Principles of Homoeomereity and of Universal Mixture, 145-46
 - on Anaximander, 51-53
 - on Eleatics, 93, 105-107 (*re* Parmenides), 110-12 (*re* Zeno), 125n and 130n (*re* Melissus)
 - on Pythagoras, 74-75
- Cosmos: *see Kosmos*
- Cosmogony:
 - Anaxagoras, 152n, 153n
 - Anaximander, 16 (Hölscher), 32 (Seligman), 35-36 (Guthrie), 50n, 55, 56, 60-61, 62n, 65n, 143-45, 175 (*see also* "Separating from")
- Empedocles:
 - vs.* change (strictly understood), 138
 - two-fold or single? 139n-41n, 139
- Pythagoras, 76, 78n-79 (Text V), 80n-83n (Raven), 87-89 (Philip)
- "Crystalline substance" (Anaximenes), 44-45
- Determinateness: *see Peras*
- Divisibility, infinite: Anaxagoras, 148-49, 157, 178
- Division: actual and potential, 115-16 (De Boer), 119, 166
- Dualism:
 - Melissus, 128n (Loenen)
 - Parmenides, 100n (Loenen)
 - Pythagoras, 81-82n (Raven, Guthrie; no: Cornford), 85n (Philip), 92, 108, 134
 - font: Orphism, XXVIII (Sinnige)
- Dynamics, Aristotle's theory: Zeno's influence, 121n (Owen)
- Elements: Anaximander, 13 (McDiarmid), 24 (Kahn) (*see also* Four elements)
- Energy as ultimate indivisible, 169n
- Finitude (*see also Peras*):
 - Aristotle's theory: state in quantity of intelligibility, actuality, perfection, 120-21, 122
- Fire (Heraclitus):
 - an *arche*, 71-72 (yes: Vlastos, Guthrie; no: Kirk)
 - finite, 70-71 (*see also Peperasmemon*)
 - outside cosmos: *aither*, 71-72n (Guthrie, Kirk; no: Vlastos)
- Fluxion theory *re* generation of figures, 77n (*see also* Point-line . . .)

- Four elements (Empedocles):
 Parmenidean in character, 138
 perfectly unified in Sphere by Love, 138n, 152n
- Geometry:
 early Pythagoreans not conversant with, 85-86 (Philip), 91
 in conflict with Epicurus' atomism 167n
- God (*theos*, *to theion*):
 Anaximander: *to apeiron*, 6 (Jaeger), 6-7 (Burch), 8 (Cherniss), 11 (Cornford), 11-12 (Matson), 25-26 (Kahn), 30 (Seligman), 35 (Guthrie), 37 (Gottschalk), 40 (Cleve), 43 (Stokes), 55-56n, 61-62, 64 (Cleve) (see also *To apeiron*)
 Anaximenes: *apeiros aer*, 68
 Melissus: Being, 126 (Guthrie; Loenen)
 Parmenides: Being, 94n, 107, 126n (Guthrie)
 Pythagoras: *peras*, not *apeiron*, 90n (Philip), 92
- To gonimon* (Anaximander), 4-5 (Text VIII), 15 (Hölscher), 29 (Classen), 32 (Seligman), 36 (Guthrie), 38 (Gottschalk), 52, 55, 60-61, 88n (Philip), 183 (Guariglia)
- Homoeomereity (Anaxagoras):
 Aristotelian in origin, 147n, 148
 Principle of, 145
- Humanism not characteristic of Presocratics, 174n
- Idealism/materialism: not relevant *re* Parmenides, 103 (Tarán)
- Idealist:
 Parmenides, 94 (no: Burnet), 100n (no: Loenen), 103 (no: Tarán)
- Implication: objective and subjective, 124n
- Indivisibility of atoms:
 interpretations:
 Furley: partless minima of an atom physically and theoretically indivisible, 164-67, 167-68n
 Guthrie: even mathematically indivisible, 161-62
 Luria: some physically indivisible, some mathematically, 161
 Vlastos: partless minima of an atom physically indivisible, mathematically divisible, 162-64
- Infinitesimals, XXIV (Mondolfo)
 in Anaxagoras, 149n (Gershenson-Greenberg)
- "Infinite": see *Apeiron* (Pythagoras); *Apeiros aer*
- Infinity (see also "Subjective Infinity"):
 Anaxagoras:
 important but not central, 155n, 177-78
re Matter: basic stuffs infinitely numerous, varied in kind and divisible, 146-50, 151, 157, 177-78
re Mind: infinite in power, extent, duration, internal constitution, 151-54, 155, 157, 178
- Anaximander: see *To apeiron*
- Anaximenes: see *Aer*
- Aristotle, 118-21
 influence of Zeno, 123-24, 166
 state in quantity of unintelligibility, potentiality, imperfection, XXIX (Sinnige), 120-21, 122
 two kinds: negative and positive, XXV-XXVI_n (Mondolfo), XXIX (vs. Sinnige)
- Atomists:
re atoms: number, shape; motion: endless; worlds: innumerable, XXX, 158, 169-70, 178-79
 state of actuality: "that which has nothing outside it" (Aristotle), XXX-XXXI, 170-73, 178-79
- Empedocles:
 characteristic of sphere as internally homogeneous and externally uniform, 139, 143n-144n.
 emphasized by Melissus (vs. Parmenides), 130-31, 134-35
- of God:
 Aquinas, other medievals, XX, XXI, XXII
 Augustine, XX-XXI
 in Homer, Hesiod, 176n (Kahn)
 and knowledge:
 Anaxagoras, 151, 178n
 Anaximander, 108, 176
 Aristotle, 120-21, 178n
 Atomists, 167, 169, 173n, 179n
 Empedocles, 137, 179n
 Epicurus, 167, 169, 173n
 Melissus, 128n (Loenen), 131
 Parmenides, 95 (Raven), 96 (Guthrie), 98-99n (Owens), 100n-101

- (Loenen), 107, 109, 177*n*
 Pythagoreans, 108, 176-77
 Melissus, like Aristotle's? 135*n* (*see also* "Infinity in magnitude")
 substituted by Melissus for Parmenides' *peras*, 131-35
 through addition and division:
 Anaxagoras, 146-50, 172*n*, 178*n*
 Anaxagoras prior to Zeno (Furley), 149, 150*n*, 172*n*, 178*n*
 Aristotle, 121-31
 Zeno, XXIX (Sinnige), 122-23, 149-50*n*
 "Infinity in magnitude" (Melissus, Fr. 3), 129-30, 131
 beginningless and endless duration (Vlastos), 130*n*
 medievals: virtual quantity, 129*n*
 qualitative sense: infinite perfection (Loenen), 129*n*
 quantitative sense: limitless extension in space (Burnet, etc.), 129-30*n*, 134-35
 same as Parmenides' *peras*: indifferent spatially and temporally (Tarán), 129
 "Infinity of the instant" (Mondolfo), XXIII
 Influence:
 of predecessors on Parmenides, 96 (Guthrie), 107*n*, 108, 134, 177
 of Parmenides on Zeno, 123*n*-24
 of Zeno on Aristotle, 121*n*-24
 Innumerable worlds:
 Anaximander, 6 (Jaeger), 7 (Burch), 9 (Cherniss), 11 (Cornford), 17-18 (Kirk), 24 (Kahn), 31 (Seligman), 36 (Guthrie), 40 (Cleve), 46-47 (no: Bicknell), 52, 58-59, 182 (Conti) (*see also To apeiron*)
 Atomists: simultaneous and successive, XXX, 158, 160, 169-72, 178
 Intellect: *see* Solutions to Zeno's arguments —Bergson; Mind
 Intellectual milieu of Anaximander, 55-59
 absence of notions, distinctions, problems, 56-59
 influence of mythologies, 55-56
 Interpretations:
 of Empedocles:
 before 1965: two cosmogonies, 139
 since 1965: single cosmogony, (Solmsen, Hölscher, Bollack), 139*n*-40
 subsequent reaction mixed, 140-41*n*
 of Zeno's arguments (*see also* Solutions):
 up to 1880, 111
 between 1880 and 1932, *ibid.*
 since 1932, 111-12
 Intuition: *see* Solutions to Zeno's arguments—Bergson

Kosmoi, 21*n* (deCorte), 40*n* (Cleve), 44-45 and 47 (Bicknell), 59, 61, 66*n*, 170, 172 (*see also* Innumerable worlds; *Ouranoi*)
Kosmos, 23 and 24 (Kahn), 27 (Solmsen)

 Limit: *see Peras*
 Line: finite if it has definite dimensions, infinite if it lacks definite dimensions (Aristotle), 120-21
Logos: *see* Fire
 Love (Empedocles):
 unites four elements into sphere, 138*n*-39, 141-44, 157 (*see also* Sphere)

 Matter: *see* Controversies on Anaxagoras; Infinity in Anaxagoras
 Matter/form:
 aligned with infinity/finitude (Aristotle), 120-21
 Pythagoras: *apeiron/peras*, 81-82, 176-77
 Methodology, XXXI-XXXII*n*, 2, 53-54, 174-75
 Microcosm: individual thing *re* universe (Anaxagoras), 151-53
 Microcosmos-macrocosmos: later than Anaximenes, 45 (Bicknell)
 Mind (*nous*): XXVIII (Sinnige)
 Anaxagoras: its characteristics: movent cause, infinite, other than matter, 153-54
 Minimal parts: *see* Partless minima
 Modern mathematicians:
 anticipated by Anaxagoras? XXIX (Sinnige), XXX (*vs.* Sinnige), 150*n* (Sinnige)
 anticipated by Zeno, 111-12, 117, 118-19*n*, 123, 124*n*
 interested in Zeno, 110-112
 Modern physics and Parmenidean Being, 97 (Guthrie)
 Monism:
 in Anaximenes, 69*n*, 73

- and Atomism, 169n
- in Parmenides, 100n (no: Loenen), 108, 134, 177
- Monisms of Anaximander, Xenophanes, Parmenides influenced by Time-deity, XXVII-XXVIII (Sinnige)
- Monistic tendencies in Milesians, 73, 81, 107-108, 133-34
- Motion:
 - Anaxagoras:
 - introduced by Mind, 153, 157
 - none in primal mixture, 152n
 - Anaximander: see *To apeiron* as moving cause
 - Zeno: modern interpreters: his arguments validate motion, 111 (*see also* Interpretations of Zeno's arguments; Solutions of Zeno's arguments)
- Motion (local):
 - for Atomists:
 - exists in and because of void, 158, 178
 - without extrinsic cause, 158
- Myths, influence upon Anaximander:
 - Hesiod, 10 (Cornford), 11 (Matson), 15-16 (Hölscher), 27 (Solmsen), 28 (Classen), 32-33 (Seligman), 42-44 (Stokes), 48 (Bicknell), 55-56
 - Hittite, 15-16 (Hölscher)
 - Phoenician: Sanchuniaton, 15-16 (Hölscher)
- Neo-humanist view on Greeks *re* infinity, XXIV
- opposed by Mondolfo, XXIV-XXVII
- Nonbeing in Parmenides: contingent existents, 99n
- Numbers: XXIV (Mondolfo)
 - infinite in two ways: dense and continuous series, 117 (Lee)
 - rational and irrational, 117-18 (Lee)
 - series: dense and continuous, 117
 - transfinite, 117
- Oceanos*, 16 (Hölscher), 33 (Seligman), 42 (Stokes)
- "Opposites":
 - Anaxagoras, 147n, 151n-53
 - actual presence in primal mixture, 152n
 - Anaximander, 5 (Vlastos), 7 (Burch), 10 (Cornford), 14-15 (Hölscher), 18 (Kirk), 23-24n (Kahn), 30 (Seligman), 34 (Guthrie), 52, 57, 61
 - presence in *to apeiron*, 9 (Cherniss), 10 (Cornford), 13 (McDiarmid), 15 (Hölscher), 18 (Kirk), 20 (Wisniewski), 24 and 25 (Kahn), 30 (Seligman), 38 (Gottschalk), 40 (Cleve), 51-52, 57-58n, 152n
 - Table of (Pythagoras), 78 (Text IV), 79, 80, 84-85n (Philip)
- Orphism, ancestor of Pythagoreanism, XXVIII (Sinnige), 80n
- Ouranoi*, 24 (Kahn), 35n (Guthrie), 45 and 47 (Bicknell), 59, 61, 66n (also see *Kosmoi*)
- Paradoxes (Zeno), XXVIII (Sinnige), 112n, 119n
 - Achilles, 113n, 116 (De Boer), 117-18 (Lee)
 - Arrow, 113n, 116n-17 (De Boer)
 - Dichotomy, 113n, 116 (De Boer), 117-18 (Lee), 121n, 123, 150
 - Stadium, 113n, 116-17 (De Boer)
- Parmenidean Being:
 - re* duration:
 - atemporally eternal, XXVI-XXVII (Mondolfo), 131n (Mondolfo, Kahn)
 - endless in time because extra-temporal, 101 (Loenen)
 - imperishable, 98 (Owens)
 - perpetually present in time, 95 (Raven)
 - temporally endless, altogether-in-present, 108, 131n, 177
- indivisible, 95 (Raven)
 - because homogeneous and full, 104 (Tarán)
 - because physical light, 98 (Owens)
 - because content of Idea of Being is self-identical, 101 (Loenen)
- interpreted as:
 - body, 94 (Burnet)
 - existence or self-identity, 102n-105 (Tarán)
 - geometrical sphere, 95-97 (Guthrie), 109, 110n and 143n (Mondolfo: spatially infinite sphere) (*see also* Sphere)
 - idea of being, 99-101 and 105n (Loenen)
 - mind, 109n (Vlastos, Phillips)
 - not incorporeal, 94-95 (Raven), 126 (no: Loenen), 132n

- peras* (determinateness, definiteness), 108, 110, 123, 134, 177*n*
- physical light, 98-99*n* (Owens), 109
- true nature of things (Verdenius), 99*n*
- Particles, subatomic, 169*n*
- Partless minima (Epicurus):
 - interpreted as:
 - extremities or surfaces of atoms (Furley), 164-67, 168
 - mathematically indivisible magnitudes (Luria, Mau), 163
 - physically indivisible elements, 163-64
 - physical measures which are sub-multiples of quantity measured (Vlastos), 163-64, 165*n*
- Peperasmenon*: Limited (Heraclitus), 70-71*n* (see also *Peras*)
- Peras*:
 - re Parmenidean Being, 110, 134 (see also Parmenidean Being)
 - completeness, 101 (Loenen)
 - heart of its reality: determinateness 108-110*n*, 134, 177*n*
 - invariancy in time/space, 96*n* (Owen)
 - metaphor for self-identity, 104*n*-105 (Tarán)
 - perfection, 94 (Burnet), 95 (Raven), 96 (Guthrie), 98 (Owens), 108, 110, 134, 177
- Pythagoras: limit, determinant, XXVIII-XXIX (Sinnige)
 - active, formal, structuring factor, 80-82 (Raven), 90-92, 176
 - linked with seed, inhaler, 80-81 (Raven), 90-92, 176
- Peras/apeiron*: see *Apeiron/peras*
- Periechein*: see *To apeiron* interpreted as surrounding
- Personifications in Parmenides: *Diké*, *Ananké*, 106*n*
- Phenomenal world rehabilitated:
 - Anaxagoras, 146-49
 - Empedocles, 137*n*-38
- Philosophy: *theorogon*, *glossogon* and *pathogon* (Cleve), 39-41
- Physis*, 58, 63, 85*n*
 - catchword for Greek philosophy of nature from Anaximander until Aristotle, 23 (Kahn)
- Pluralism, not monism in Anaximander, 14 (McDiarmid), 14-15 (Hölscher)
- Poetry, source of exegetical difficulties in
 - Parmenides, 105-106*n*, 130-31
- Point-line-surface-solid scheme (Pythagoreanism), 77*n*, 86-87, 89, 91
 - replaced by "fluxion" theory, 77*n*, 84*n*
- Positive statements, 103*n*
- Presocratics:
 - Aristotle's and/or Theophrastus' accounts of, 1*n*, 9 (Cherniss), 12-13 (McDiarmid), 18 (Kirk), 22-23 (Kahn), 26-27 (Solmsen), 29 (Seeligman), 34 (Guthrie), 36-38 (Gottschalk), 52, 59, 172*n*, 183 (Guariglia)
 - controversial interpretations, 2
 - difficulties in studying, 1*n*-2
- Pythagoreanism:
 - early stages: Aristotle's evidence (Philip), 84-90
 - peras/apeiron*: three roles, 87-88
 - no technical mathematics, 85-86, 91
 - Plato's One-Dyad, 87
 - pre-Parmenidean (Raven), 75-83
 - contrasted with Milesians, 76
 - cosmogony, 80*n*-81
 - numbers spatialized, 76-77
 - origin of number 1, 78-81, 82-83
 - peras/apeiron*, 78-83, 176-77
 - unit is *peras*, 79-81, 82
 - post-Parmenidean (Raven), 82-83
 - origin of unit, 82-83
 - unit is *peras/apeiron*, *ibid.*
- Reaction to Parmenides:
 - Anaxagoras, 146-49, 153, 177-78
- Atomists, 156-61
 - atoms Parmenidean because homogeneous in nature, 158, 159, 169, 178
- Empedocles, 137-38
- Reconstruction of early Greek thought:
 - exterior and internal, 182-83 (Guariglia)
- "Roots" of Empedocles, 138
- "Separating from" or "-out" (Anaximander), 4-5 (Text IV, VII, VIII), 7 (Burch: emanation), 14 (Hölscher), 35-36 (Guthrie), 37 and 38 (Gottschalk), 52, 60-61, 62*n*, 108, 153 (re Anaxagoras)
- Sense-perception:
 - defended by Empedocles, 137
 - not criticized by Melissus (Loenen), 128*n*

Solutions to Zeno's arguments:

Bergson:

change vs. things, 113-14 (De Boer)
intuition vs. intellect, 113

De Boer: continuum = potentially but
not actually divided, 115-17

Lee: logico-mathematical theory based
on Dedekind and Cantor, 117-19

Russell:

change = different relationships in
places and times, 114-15
retention of intellect and "things,"
114-15

Space:

Anaximander, XXIV, XXVI-XXVII
(Mondolfo), 58

Atomists: *see* Void

Melissus, 125 (Raven), 126 (Guthrie,
Loenen), 129-30n, 132

Parmenides, 94, 96, 126 (Loenen)

Zeno, as interpreted by

Bergson, 113n-14

De Boer, 116-17

Lee, 118

Russell, 115, 124n

Sphere:

Empedocles:

characterized as *apeiron*, 139, 141-44
four elements under influence of
Love, 138, 152n

similar to Anaximander's *to apeiron*,
142, 152n

like Melissus' Being? 143

like Parmenides' Being? 138n, 142-
43n

Parmenides:

literal description of reality, 94
(Burnet)

metaphor *re* reality, XXVI (Mon-
dolfo), 95 (Raven), 96n (Owen),
98 (Owens), 101 (Loenen), 105
(Tarán), 110n and 143n (Mondolfo)

Strife (Empedocles), 138, 139, 142n, 157
resides outside Sphere, 142n

"Subjective infinity" (Mondolfo), XXIV

Tetractys, 76n, 85

Theos, to theion: *see* God

Time:

in Anaximander's Fragment, 2-3

To apeiron serves as judge and place of
expiation, 180-81 (Carbonara Nad-
dei)

deity of ancient myths: ancestor of
Anaximander's *to apeiron*, of
Xenophanes' and Parmenides' po-
sitions XXVII (Sinnige)

Greek notion from astral time, 22
(Kahn)

Unit:

in pre-Parmenidean Pythagoreanism
(Raven):

odd number, 82 (Text VII)

seed, limit, 78-79 (Text V), 80-81, 88n

in post-Parmenidean Pythagoreanism
(Raven):

even/odd, 82 (Texts VIII and IX), 83

Void:

Atomists:

exists but is unreal, 156-57, 158n, 165,
178

infinite, XXX, 169, 170-73

Empedocles and Anaxagoras: unreal,
137n, 157, 158n

Melissus:

absent from within Being, 127-28n
(Loenen; no: other scholars)

non-existent, unreal, 133, 157n

Pythagoreans, 79 (Text VI), 81, 86, 95,
96, 107n, 108, 176

Parmenides: non-existent, 96, 157n

World-picture in authors of sixth and
fifth centuries, 65-66

Worlds, innumerable: *see* Innumerable
worlds

INDEX OF PASSAGES

A page-number accompanied by the letter 'n' in roman type indicates footnote; a page-number accompanied by the letter 'n' in italics indicates body of text and footnote. Rather frequently, only the first line of the passage is specified in the references. Gratitude is due David Gilson, who helped compile this Index, and Elizabeth Reilly, who typed it.

ACHILLES

Isagoge in Arati Phaen., 4
[Text III: Xenophanes] 70

AETIUS

I, 3, 4 [Text IV: Anaximenes] 45, 67,
68*n*
I, 7, 13 [Text III: Anaximenes] 67, 68*n*
II, 6, 3 91*n*
II, 14, 3 44
II, 24, 9, [Text II: Xenophanes] 70

ALCMAEON

24A12 21

ANAXAGORAS

Fr. 1 148, 151*n*, 152*n*, 172*n*
Fr. 3 148, 149, 150, 172*n*
Fr. 4 153*n*
Fr. 5 XXIX, XXX
Fr. 6 XXIX, XXX, 148
Fr. 12 153-54
Fr. 14 154
Fr. 17 146-47*n*
Fr. 21 178*n*

ANAXIMANDER

Fr. 1 4, 5 6, 7, 8, 11, 12, 13, 15, 18, 21,
23, 24, 26, 28, 30, 34, 41, 46, 66*n*

ANAXIMENES

Fr. 2 68*n* (also see Aetius, I, 3, 4)

ANTIPHON THE SOPHIST

87 B 10 26

ARISTOTLE

Categories, 205a1-14 119*n*
De Caelo, 275b30 [Text III: Atomists]
158, 169
De Caelo, 303a5 [Text IV: Atomists]
159, 168
De Caelo, 303a11 [Text V: Atomists]
159, 169
De Caelo, 303a20 [Text VI: Atomists]
159, 168
De Caelo, 306a26 [Text VII: Atomists]
159, 168
On Democritus see Simplicius, *In De Caelo*, 295, 1
De Gen. et Cor., 314a21 [Text VIII: Atomists] 159, 168, 169
De Gen. et Cor., 325a2 [Text I: Atomists] 156, 168, 169
De Gen. et Cor., 325a14 128, 133
De Gen. et Cor., 332a19 [Text VI: Anaximander] 4
Meta., 985b4 [Text II: [Text II: Atomists] 158, 168
Meta., 985b23 [Texts II-IV: Pythagoreans] 78, 79, 82, 83, 85, 86
Meta., 986a15 [Text IX: Pythagoreans] 82, 83
Meta., 986a17 88
Meta., 986a18-21 88
Meta., 987b28 88

Meta., 989b31 82n
Meta., 1001b7 84n
Meta., 1048b10 87
Meta., 1069b20 14
Meta., 1069b22 37
Meta., 1080b20 80
Meta., 1091a12 [Text V: Pythagoreans]
78-79, 80, 86, 88n
Phys., 187a12 [Text IV: Anaximander]
4, 14
Phys., 187a20 14, 37
Phys., 187a23 sq. [Text I: Anaxagoras]
148, 149
Phys., 187b6 147n
Phys., Bk. III, chs. 4-5 (202b30-206a8)
XXXI, 170, 172
Phys., 203a4 176n
Phys., 203a18 170n, 172n
Phys., 203a33 170
Phys., 203b4-15 [Text III: Anaximander]
3, 21n, 62
Phys., 203b7 68n
Phys., 203b10 26, 27, 37, 45, 47
Phys., 203b11 59, 60, 90
Phys., 203b15 35, 46
Phys., 203b23 172n
Phys., 203b25 170n
Phys., 203b27 46
Phys., 204b22 [Text V: Anaximander]
4
Phys., 205a1 70n
Phys., 205b1 152n
Phys., Bk. III, chs 6-7 (206a9-208a4)
170, 178n
Phys., 206a18 170-71
Phys., 206a27 171
Phys., 206b33 135n, 171n
Phys., 207a1 171n
Phys., 207a2 143n
Phys., 207a7 171
Phys., 207a8-14 171n
Phys., 207a21 37
Phys., 207a25 178n
Phys., 213b14-15 90n
Phys., 213b22 [Text VI: Pythagoreans]
79, 80, 81, 82, 83, 86, 90,
Phys., 227a10 119n
Phys., 231a21 166
Phys., 231b10 119n
Phys., 232b25 119n
Phys., Book VI, ch. 7 (237b23-238b22)
120n, 166

DIOGENES LAERTIUS

I, 35 XXVII
I, 36 XVII
IX, 8 70n
IX, 30 [Text XII: Atomists] 160, 169,
170

EMPEDOCLES

Fr. 3, 9 137
Fr. 11 137
Fr. 12 137
Fr. 13 137n
Fr. 14 137n
Fr. 17, 6-12 138
Fr. 17, 7 141n
Fr. 17, 16-20 137
Fr. 17, 32 137
Fr. 17, 35 138
Fr. 27 139, 141n, 143n, 152n
Fr. 28 138n, 139, 143n, 152n
Fr. 29 138n
Fr. 35, 5 152n

EPICURUS

Letter to Herodotus, 39 172
Letter to Herodotus, 40 172
Letter to Herodotus, 41 163, 172-
73n
Letter to Herodotus, 56 167
Letter to Herodotus, 56. 5-59 164
Letter to Herodotus, 57 167, 173n
Letter to Herodotus, 58 165n
Letter to Herodotus, 59 162, 167

EUCLID

Elements, V 163
Elements, VII 86

GREGORY OF NAZIANZEN

Orat., XXXVIII, 7, 9 XVIII

HERACLITUS

Fr. 30 22, 71, 72
Fr. 60 22
Fr. 64 72
Fr. 103 21

HESIOD

Theogony, 116 sq. 27, 32, 55
Theogony, 736 28

HIPPOLYTUS

- Refutatio* I, 6, 1 [Text II: Anaximander]
4, 47, 59, 60, 62, 64n
Refutatio, I, 6, 3 [= DK 12A11] 28
Refutatio, I, 7, 1, [Text II: Anaximenes]
67, 68
Refutatio, I, 14, 3, [Text I: Xenophanes]
70

MELISSUS

- Fr. 2 2, 129, 130, 131n, 133
Fr. 3 129n-30n, 131n, 132, 133
Fr. 4 130, 131n, 132, 133
Fr. 5 26, 131n
Fr. 6 131n
Fr. 7 46, 131n
Fr. 7, 7-10 127-28, 131, 133
Fr. 8 131
Fr. 9 125-27
Fr. 10 131

ORIGEN

- De Prin.*, II, 9, 1 XVIII

PARMENIDES

- Fr. 2 109n
Fr. 2, 3 94, 96n, 99n
Fr. 2, 3-5 102
Fr. 2, 5 99n
Fr. 3 100n, 109n
Fr. 4 100n
Fr. 5 100n
Fr. 6 100n, 109n
Fr. 6, 4-9 107n
Fr. 8 93, 106n
Fr. 8, 2 99n
Fr. 8, 3 XXVI
Fr. 8, 3-6 135
Fr. 8, 3-21 101
Fr. 8, 4 XXVIII, XXXn, 26, 100, 101, 105n
Fr. 8, 5-6 XXVI
Fr. 8, 6-10 21
Fr. 8, 12 105, 107n
Fr. 8, 13-15 104, 106
Fr. 8, 22 104
Fr. 8, 22-24 107n
Fr. 8, 22-25 XXVI, 101
Fr. 8, 22-27 107n
Fr. 8, 26 101
Fr. 8, 26-27 104, 106, 130n
Fr. 8, 30-31 104, 106, 130

- Fr. 8, 32 XXX, 101
Fr. 8, 33 105
Fr. 8, 37-38 104, 106
Fr. 8, 38 100
Fr. 8, 42 XXX, 101, 138n
Fr. 8, 42-44 131
Fr. 8, 42-47 107n
Fr. 8, 42-49 95
Fr. 8, 43-44 98, 104, 106
Fr. 8, 44-48 XXVI
Fr. 8, 49 104, 138n
Fr. 9.1 98
Fr. 10 106n
Fr. 10, 5-7 106n
Fr. 16 100n

PLATO

- Phaedrus*, 245D 21
Timaeus, 47A 22

PLOTINUS

- Enneads*, III, 8, 10, 15 58
Enneads, IV, 4, 45, 18 58
Enneads, V, 5, 10, 11 XXVII
Enneads, VI, 7, 13, 3 58
Enneads, VI, 7, 15, 17 58

PSEUDO-PLUTARCH

- Stromateis* 2 [Text VIII: Anaximander]
4, 15, 55, 60, 65n

SIMPLICIUS

- In De caelo*, 242, 18 [Text XI: Atomists]
160, 169
In De caelo, 293, 18 138n
In De Caelo, 295, 1 [Text IX: Atomists]
159
In Phys., 23, 33 72n
In Phys., 23, 33-24, 4 70
In Phys., 24, 13, [Text I: Anaximander]
2, 6, 47, 59, 183-84
In Phys., 24, 18 15
In Phys., 24, 21, [Text VII: Anaximander]
4, 14
In Phys., 24, 25 14
In Phys., 24, 26, [Text I: Anaximenes]
67, 68
In Phys., 24, 28 XXX, 61, 68
In Phys., 27, 2 148n
In Phys., 27, 19 152n
In Phys., 28, 7 [Text X: Atomists] 160, 169

In Phys., 139, 18 165
In Phys., 150, 24 14
In Phys., 152, 22 [Text V: Anaximenes]
 67, 68
In Phys., 154, 15 14-15
In Phys., 155, 26 151n
In Phys., 156, 1 153n
In Phys., 156, 13 153
In Phys., 156, 21 153
In Phys., 157, 7 154
In Phys., 163, 20 146-47n
In Phys., 164, 3 154n
In Phys., 164, 14 [Text II: Anaxagoras]
 148-49
In Phys., 460, 10 149n
In Phys., 460, 15 146n

In Phys., 460, 28 151
In Phys., 461, 8 149n

SPEUSIPPUS

apud *Theologumena Arithmeticae*, p. 84
 [Text I: Pythagoreans] 77, 78

STOBAEUS

Anth., I, 18, 1c 80n

THEO SMYRNAEUS

p. 21, 20 [Text VII: Pythagoreans] 82
 p. 22, 5 [Text VIII: Pythagoreans] 82,
 83

ZENO

Fr. 1 120, 122, 123, 150, 165
 Fr. 3 120, 122, 123, 150

INDEX OF NAMES

A page-number accompanied by the letter 'n' in roman type indicates footnote; a page-number accompanied by the letter 'n' in italics indicates body of text and footnote. The index does not include the bibliography (pp. 185-205). Gratitude is due to David Gilson and Janice Cross, who helped compile it, and to Elizabeth Reilly, who typed it.

- Afnan, 73n
 Agolia, 62n
 Alcmaeon, 5, 22, 78n
 Alexander of Aphrodisia, 17
 Aëtius, 1, 8, 36, 40, 44, 45, 48, 67, 80n, 183
 Anaxagoras, XXII, XXIV, XXV, XXVIII, XXIX, XXX, 7, 11, 14, 15, 21, 26, 27, 37, 38, 88n, 124n, 133n, 135n, 136, 140, 144-55n, 157, 158n, 161, 165n, 169, 172n, 175n, 177, 178n
 Anaximander, XVII, XXIV, XXV, XXVIII, XXX, 1-53, 55-65n, 67, 68, 69n, 81, 86, 88n, 89n, 90n, 91, 106n, 107n, 108n, 110n, 134, 140, 142, 143n, 153, 155, 175n, 176n, 180, 181, 182, 183
 Anaximenes, XXVIII, 26, 42, 43, 44, 45, 47, 48, 66n, 67n-69n, 70, 71, 72, 73, 81, 91, 95, 108n, 134
 Anselm, XVIII
 Antiphon The Sophist, 26
 Aquinas, XX, XXI, 105n, 129n
 Apollodorus of Alexandria, 1
 Archer-Hind, XXVIII
 Archimedes, XXIV
 Archytas, 84, 85
 Aristarchus, XXIV
 Aristotle, XVII, XXI, XXII, XXIV, XXV-XXVI, XXIX, XXXI, 1n, 3n, 4, 6, 8, 9, 10, 11, 12, 13, 14, 15, 17, 19, 21, 23, 27, 30, 34, 36, 37, 38, 46, 52, 56, 57, 58, 59, 65, 69n, 72, 74, 77n, 78, 82, 83, 84n, 86, 87, 88, 91n, 92, 100n, 102n, 111, 116n, 117, 118n, 119, 120-121n, 122, 135n, 141n, 146, 147n, 150n, 154n, 156n, 157, 164n, 165, 166, 167n, 168, 169, 170n, 171, 172, 173n, 178n, 183
 Aristoxenus, 74, 79n, 91n
 Armstrong, XXI, 97n
 Arnim, von, 139n
 Atomists, XXII, XXIV, 58, 155-73, 178 (*also see* Democritus; Leucippus)
 Augustine, XXn-XXIn
 Avicenna, 105n
 Bădărașu, 76n
 Bailey, 136n, 137n, 144, 147n, 152n, 155n, 158n
 Ballauff, 26, 50n
 Barnes, 143n
 Basson, 107n
 Beman, 118n
 Bergson, 112, 113-14n, 115, 116
 Bicknell, XXX, 41, 44-49, 50, 51, 55, 59, 60, 61, 62n, 63n, 64n, 66n, 68, 70n, 81n, 179n
 Bignone, 26
 Boer, de, 112n-17n, 119, 121n
 Bollack, XXXn, XXXIII, 139n, 140, 141, 143n, 179n
 Bolzano, XXIX, 124n, 150n, 178n
 Bonaventure, 129n
 Booth, 110, 111n, 112n, 123n, 125n, 130n
 Bowra, 106n, 107n
 Brochard, 26, 111n
 Brock, 91n
 Brumbaugh, XXIIIn, 112n
 Brunschwig, 141n
 Burch, XXX, 6-7, 11, 50, 51, 56, 62n

- Burkert, 74n, 79n, 80n, 91n, 107n, 175n, 176n
 Burnet, 6, 7, 10, 17, 21n, 24, 29, 30, 31, 34, 41, 50, 73n, 79n, 93n, 94, 100n, 105, 106, 125n, 127, 128n, 129, 130n, 139, 140
 Bury, XXIII
 Cajori, 111n, 112n
 Calogero, XXVIn, 93n, 110n, 111, 113n, 138n, 143n
 Cantor, XXIX, 111n, 112, 117n, 119, 124n, 150n, 178n
 Cappelletti, 145n
 Carbonara Naddei, 50n, 180-81, 182
 Chappell, 118n
 Cherniss, XXVn, XXXIII, 8-9, 12, 29, 30, 34n, 37, 38, 50, 52, 56, 57, 76n, 132n
 Chevalier, 26
 Chrosara, 113n
 Classen, C., 28-29, 50, 51, 52, 53, 55, 63n
 Clement of Alexandria, 1
 Cleve, XXX, 39-41, 50, 51, 52, 64, 73n, 91n, 144n, 145n, 147n, 151n, 152n, 153n
 Cohn, XXIII
 Conti, 181-82
 Corbato, 69n
 Cornford, XXVn, 9-11, 18, 19, 24, 25, 30, 31, 34, 39, 47, 50, 51, 52, 53, 57, 58, 59, 62n, 63n, 69n, 70n, 75, 79n, 80, 82n, 84n, 86, 90n, 93n, 97n, 109n, 123n, 142n, 145n
 Corte, de, 21n, 56n, 69n, 71n
 Cousin, 111n
 Coxon, 105n
 Cratylus, 103n
 Crombie, 78n
 Cronus, 164
 de: *see next name*
 Dedekind, 111n, 117, 118n, 119n, 124n
 Deichgräber, 40
 Democritus, XXII, XXIV, XXVIII, XXIX, XXX, 12, 15, 58, 136n, 155n, 156n, 157, 158, 159, 161, 162, 165, 166, 168, 169, 170, 171n, 172n, 173n, 174n, 179n
 Detienne, 92n, 145n
 Dicaearchus, 74, 91n
 Dicks, 22n, 182
 Diels, 24, 30, 34, 41, 139n
 Diels-Kranz, 3n
 Diogenes of Apollonia, 47, 67, 68n, 174n, 183
 Diogenes Laertius, 1
 Empedocles, XXVIII, XXXn, 5, 14, 21, 27, 37, 44, 57, 85n, 110n, 130n, 133n, 136, 137-44, 148, 152n, 157, 158n, 161, 175n, 179n
 Epicurus, 49n, 162n, 163, 164, 165n, 166, 167n, 168, 172n, 173n, 179n
 Esnoul, 28n
 Euclid, 86, 163
 Ezekiel, 16
 Franchini, 180
 Frank, XXIII
 Fränkel, XXII, XXX, 62n, 66n, 93n, 106n, 109n, 110n, 113n, 122n, 123n, 124n, 177n
 Frege, 119n
 Fritz, von, XXXIII, 91n, 109n, 137n, 143n, 145n, 152n
 Furley, XXX, XXXIn, XXXIII, 123n, 124n, 125n, 130n, 150n, 156n, 157n, 158n, 159, 161n, 164n, 165n, 167n, 168, 170n, 172n, 173n
 Gaye, 46
 Gershenson, 145n, 147n, 148n, 149n, 151n
 Gigon, 73n, 150n, 152n
 Gilson, XXn-XXIn
 Gladisch, 181
 Goethe, XXIV
 Gomperz, 125n, 155n, 180
 Gorgias, 99n, 174
 Gottschalk, XXX, 36-39, 50, 51, 52, 53, 55, 56, 58, 59, 61n, 62n, 65n, 142n
 Greenberg, 145n, 147n, 148n, 149n, 151n
 Gregory of Nazianzen, XVII
 Grene, 169n
 Grey, 99n, 108n
 Grote, 111n
 Grünbaum, 124n
 Guariglia, 36n, 182-84
 Guazzoni Foà, 26, 50, 51, 57, 110n, 143n
 Guthrie, XXI, XXX, XXXI, XXXII, XXXIII, 33-36, 39, 44, 47, 50, 51, 52, 53, 55, 56n, 57, 59, 60, 62n, 63n, 65n, 68n, 69n, 71, 74, 76n, 78n, 80n, 81n, 88n, 90n, 92n, 93n, 95, 96n, 97n, 106, 109n, 110, 112n, 121n, 125n, 126n, 128n, 129, 130n, 133n, 137n, 142n, 144, 145, 149n, 150n, 152n, 153, 154, 155n, 156n, 157n, 158n, 161, 167, 168, 174n, 175, 179n
 Guyot, XXIII

- Hammer-Jansen, XXVIII
 Harrison, 121n
 Havelock, 107n
 Heath, 90n, 124n
 Hegel, 31, 180, 181
 Heidegger, XXVIIIIn, 49, 50, 109n, 181
 Heidel, 25, 30, 38, 41, 63, 91n, 123n, 124n
 Helm, 73n
 Henry of Ghent, XX
 Heraclides of Pontus, 74
 Heraclitus, XXIV, 66n, 70-72n, 73, 85n,
 89, 93, 107n, 108n, 126, 181
 Herodotus, 74
 Herrero, 107n
 Herzog, 69n
 Hesiod, 9, 10, 11, 15, 16, 27, 28, 32, 42, 43,
 44, 55, 56, 70, 88, 107n, 176n, 182
 Hill, XXIV, XXVn
 Hintikka, 120n, 179n
 Hippasus of Metapontum, 70, 91n
 Hippolytus, 1, 3, 6, 46, 47, 59, 67, 183
 Hölscher, XXXn, 14-17, 23, 30, 34, 50, 52,
 53, 55, 56n, 63n, 139n, 140, 141n
 Homer, 107n, 176n
 Hueffmeier, 68n
 Huit, XXIII, 57n
 Hume, 164
 Huntington, 117n, 118n
 Husserl, 31

 Iamblichus, 74, 85, 91n
 Ilting, 74n, 90n
 Irenaeus, 1
 Isocrates, 74

 Jaeger, XXIV, 6, 8, 11, 18, 50, 51, 52, 56,
 94n, 138n, 139n, 142n, 151n, 180
 Janssens, 155n
 Jeremiah, 16
 Joachim, 17
 Joly, 164n

 Kahn, XXVIIIn, XXXIII, 1n, 2n, 20-26,
 31, 47, 48, 50, 51, 52, 55, 57, 58n, 59,
 63n, 66n, 71n, 81n, 90n, 97n, 102n, 105n,
 109n, 131n, 139, 140, 142n, 143n, 145,
 176n
 Kapp, 21n
 Kerferd, XXXIII, 2n, 50n, 51, 53, 66n,
 67n, 70, 73n, 75, 92n, 97n, 124n, 125n,
 130n, 132n, 139, 144, 145n, 146n, 154n,
 174

 Kerschensteiner, 24n, 66n, 72n, 73n, 107n,
 143n, 151n, 152n, 154n, 157n
 Kirk, XXI, XXXI, XXXII, XXXIII, 17-
 19, 23, 30, 31, 50, 51, 52, 53, 55, 56n,
 59, 65n, 72n, 73n, 75, 175
 Kirk-Raven, 1n, 2n, 3n, 53, 77n, 78n, 79n,
 81n, 86n, 92n, 128n, 133n, 137n, 153,
 154, 155n, 156n, 158n
 Knight, 128n
 Kranz, 18
 Kraus, XXX, 7-8, 50, 52, 62n
 Kröber, XXIIIn, 50n, 77n
 Kucharski, XXIII, 57n, 74n

 Lämmli, 73n, 143n, 151n, 153n
 Lee, 112, 113n, 117-19, 123n
 Lessing, XXIV
 Leucippus, XXX, XXXIn, 47, 58, 133n,
 136n, 155n, 156n, 157, 158, 159, 161,
 162, 165, 166, 168, 169, 170, 171n, 172,
 173n, 174n, 178, 179n
 Liddell-Scott, 60
 Lloyd, XXXIII, 24n, 57, 79n, 136n
 Loenen, 49, 69n, 93n, 99n-101, 102n, 105n,
 106, 124, 126, 127, 128n, 129, 130n, 133n
 Long, A. A., 179n
 Long, H. S., 142n
 Longrigg, 68n, 143n
 Lucretius, 140, 164n
 Luria, 161, 163
 Luther, 179n

 Macquarrie, XVIIIn
 Maddalena, 180
 Malcolm, XVIIIn
 Mansfeld, 93n, 106n, 108n
 Matson, 11, 50, 52, 56, 158n
 Mau, 163
 Mayor, 73n
 Mazzantini, 26
 McDiarmid, 12-14, 17, 23, 29, 30, 31, 34n,
 37, 38, 50, 51, 52, 57, 142n
 McGibbon, 154n, 158n
 McKeon, 46
 Melissus, 19, 21, 26, 53, 110n, 124-35n,
 143, 154n, 157, 158n, 165, 166, 177
 Melsen, van, 168n, 169n
 Minar, 139n, 141n, 145n
 Mondolfo, XXIII, XXVIIIn, XXXn,
 XXXIn, XXXIII, 26, 41, 50n, 52, 57n,
 73n, 110n, 124n, 130n, 131n, 143n, 149n,
 172n
 Montero, 177n

- Moorhouse, 158n
Mourelatos, 49n, 94n, 96n, 99n, 100n,
104n, 106n, 107n, 109n, 131n
Mugler, 49, 57n, 64

Natorp, XXVIII, 26
Neugebauer, 90n
Nicolaus of Damascus, 69n
Nietzsche, 6, 24, 41, 50
Noel, 111n

O'Brien, D., 139n, 140, 141n, 142n, 143n,
152n
O'Brien, J. F., 117n
Onian, 21n
Origen, XVIII
Otto, XXIV, 26
Owen, XXXIII, 96n, 122n, 131n, 167n
Owens, XXXII, XXXIII, 73n, 97n-99,
100n, 103n, 104n, 105n, 106, 109, 127,
128n, 129, 130n, 133n, 136, 144, 150n,
151n, 153n

Padrón, 62n
Parmenides, XXII, XXIV, XXV, XXVI,
XXVII, XXVIII, XXX, 5, 26, 44, 57,
75, 76, 81, 83, 84n, 89, 93n-110n, 111,
114, 115, 123n, 127, 128n, 129, 130n,
131n, 132n, 133n, 134, 136, 138, 140,
142n, 143n, 147n, 149, 150n, 153, 155,
156, 157n, 158, 165, 166, 169n, 177n, 178
Peck, 145n, 147n, 153n
Philip, XXXIII, 70n, 75, 84-90n, 91n, 92n
Phillips, 93n, 109n
Philo, XXIV
Philo of Byblos, 15
Philolaus, XXIV, 84n, 85
Pirenne, 28n
Planck, 97
Plato, XXI, XXII, XXIV, XXVII,
XXVIII, XXIX, XXXIII, 7, 23, 27, 65,
73n, 74n, 78n, 87, 89, 92n, 99n, 154n
Plotinus, XVII, XXI, XXII, 57n, 58n, 64n,
65
Plutarch, 1, 26
Pohlenz, 63
Pomerans, 169n
Porphyry, 74, 79n, 91n
Pozsgay, 119n
Pró, 28n, 50n
Proclus, XXI, XXII, 85
Pseudo-Dionysius, XXI, 7
Pseudo-Plutarch, 1, 14, 60, 183

Pythagoras, XXV, XXVIII, 53, 74-92,
108n, 110, 176

Ramnoux, 49, 50, 140
Raven, XXI, XXXI, XXXIII, 18, 75-83n,
84n, 85, 86, 87, 91, 94, 95, 97, 123n, 124,
125, 128n, 129, 130n, 132, 133, 141n,
144, 150n, 154n, 175 (*see also* Kirk-
Raven)
Reesor, 146n
Renou, 28n
Rescher, 50n, 65n, 66n
Rey, 26
Riezler, 100n
Rist, 164n
Ritter, 24
Robin, 180
Rohde, 41, 74n
Romano, 154n
Ross, 3n, 170n
Röth, 181
Russell, 111, 112, 114-15n, 117n, 118n,
119n, 123n, 124n
Ryle, 113n

Salmon, 112n, 113n, 121n
Sambursky, 155n
Samson, 179n
Sanchuniaton, 15, 55
Santillana, de, 136n
Schick, 93n, 97n
Schiller, XXIV
Schröder, von, 21n
Schrödinger, 93n
Schwabl, 107n
Scotus, XVIII, XX
Seidel, 49n, 109n
Seligman, 2n, 29-33, 38, 50, 51, 52, 53, 56,
56, 59, 62n, 63n
Sextus Empiricus, 1
Siegel, 128n
Simplicius, 3n, 6, 12, 14, 17, 21, 23, 28, 36,
46, 47, 59, 67, 68, 70, 105n, 111, 146,
151, 183
Sinnige, XXIII, XXVII-XXXI, 56n, 57n,
62n, 69n, 77n, 78n, 80n, 81n, 92n, 106n,
108n, 110n, 113n, 121n, 123n, 124n,
137n, 142n, 143n, 147n, 150n, 154n,
155n, 156n, 173n, 178n
Smiley, XXV
Snell, 179n
Socrates, 174

- Solmsen, XXXn, XXXIII, 26-28n, 50, 51, 53, 55, 60, 63, 64n, 65n, 68, 110, 123n 139n, 140, 141n, 143n, 152n, 155n, 157n 158n, 173n
 Somigliana, 28n
 Sotion of Alexandria, 1
 Speusippus, 77
 Spinoza, 109n
 Sprague, 103n, 105n, 107n
 Stenzel, XXIV, 106n
 Stobaeus, 1
 Stogre, 119n
 Stöhr, 73n
 Stokes, 28n, 41-44, 49, 51, 53, 55, 56n, 62n 66n, 68n, 139, 152n
 Strang, 145n
 Strodach, 172n
 Sweeney, XXVIN, 102n, 120n, 129n

 Tannery, XXIII, 26, 39, 62n, 111n, 123n, 139n
 Tarán, XXXn, XXXIII, 69n, 93n, 102n-105n, 106n, 107n, 108, 109n, 128n, 129, 130n, 131n, 133n, 137n, 157n
 Tate, XXVII
 Taylor, C. C. W., 179n
 Taylor, R., XVIIIIn
 Thales, XVII, XXII, 3, 13, 15, 31, 42, 70, 72, 90n, 181
 Theophrastus, 1n, 3, 6, 9, 10, 12, 13, 14, 15, 18, 19, 23, 28, 29, 34, 37, 70, 72n, 141n, 146, 152n, 183
 Thesleff, 74n
 Thomson, G., 10n
 Thomson, J., 118n
 Timaeus, 91n
 Tumarkin, XXIII, 57n

 Ushenko, 113n

 van: *see next name*
 Verdenius, 99n, 179n
 Vlastos, XXXIn, XXXIII, 5n, 28n, 30, 38, 50, 52, 53, 56, 68n, 71, 72n, 90n, 92n, 109n, 111n, 121n, 122n, 123n, 125n, 127, 130n, 132n, 133n, 144n, 145n, 147n, 150n, 161, 162n-64, 165n, 167, 168, 172n, 177n, 179n
 Vogel, de, XXXIII, 74n, 90n, 91n, 92n
 von: *see next name*

 Weizsäcker, von, 169n
 West, 79n
 Wheelwright, XXIIIn
 Whyte, 169n
 Wilford, 141n
 Winckelmann, XXIV
 Wiśniewski, XXX, 20, 50, 51, 52, 93n, 142n
 Wolf, 49n
 Wolters, 99n
 Woodbury, 109n

 Xenophanes, XXVIII, 66n, 69, 70, 73n, 107n, 110n, 126n, 145n, 152n

 Zafropulo, XXV, 93n
 Zarathustra, 73n
 Zeller, XXVIII, 21n, 24, 47, 109, 139n, 140, 181
 Zeno of Elea, XXIV, XXVIII-XXIX, XXX, 19, 53, 75, 76, 83, 84n, 110n-24, 127, 130, 132n, 134, 135n, 149, 150n, 161n, 162n, 165n, 166, 167n, 169, 177, 178
 Zeppi, 69n, 133n
 Zoroaster, 73n